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Research Article

Business Analysis and Development Strategy of Seaweed Cultivation in South Sulawesi, Indonesia: Regression Analysis

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ABSTRACT

Seaweed farming operations have not only resulted in a battle over maritime areas and resources, but have also led to changes in the values of communities. Communities have sacrificed the social ideals of common care in favor of individual economic advantages. The research aimed to analyze decisive business potential determine the feasibility of seaweed cultivation, the social and economic issues that have been investigated in the seaweed industry, as well as those that have been overlooked. This research was conducted in September – November 2022. Data were collected using the method of observation, interview, and literature study. Determination of the samples in this study was performed by simple random sampling, and the number of respondents was 150 people, The statistical analysis applied was regression, The logit model is the model that may be applied to ordinal logistic regression. the income level of seaweed cultivation was IDR 1,097,082 per production cycle. Seaweed cultivation was feasible to continue because the R/C ratio was 1.99 (beneficial category). The chart value was in quadrant III (weak and likely policy). variables such as Land Ownership, Farming Commodities, Mastery of Tools and Machines, Use of Labor, Use of Production Facilities Use of Capital is significant influence. The research findings show that seaweed cultivation is feasible to develop seaweed business by providing training and business help to increase the skills and quality of seaweed resources. Optimizing marketing carrying capacity to raise income and cover operating costs, promoting items to a large market, and enhancing quality assurance.

Keywords: Business Analysis, Aquaculture, Feasibility, Seaweed Cultivation, Seaweed farming.

JEL Classification: M21, O11

1. Introduction

Determine the viability of seaweed production, as well as identify social and economic problems that have been handled in the seaweed sector and those that have been overlooked. Seaweed cultivation has led to conflict over maritime regions and resources, as well as changes in community values. Communities have abandoned the social principles of shared care in favor of personal economic rewards, as seen by the social and economic components included in seaweed sector studies, as well as the aspects disregarded. Seaweed farming operations have not only resulted in a battle over maritime areas and resources, but have also led to changes in community values, in which communities have compromised the social ideals of common care in favor of individual economic gains (Hussin & Khoso, 2017). Seaweed (*Eucheuma cottonii*) is a common traditional dish in Asian nations. As far as we are aware, not many research have looked at the relationship between seaweed consumption and cardiovascular disease

mortality. We looked at the relationship between the frequency of consuming seaweed and the overall and particular mortality rates from cardiovascular disease (Kishida, et al., 2020), and Export information from exporting nations that met China's seaweed needs from 2012 to 2021 was used in the study. The data was analyzed using the approximately ideal demand system (AIDS) and revealed symmetric comparative advantage (RSCA). Indonesian seaweed (HS 121229) has a comparative advantage in the Chinese market, according to the data. Nonetheless, the comparative advantage of Indonesian seaweed remains inferior to that of its rivals (Hendra, 2023). Over the past 25 years, the demand for seaweed and related derivatives has skyrocketed worldwide. On the other hand, seaweed production on the African continent and its outlying islands has a significant potential to meet global demand. Africa produces and uses seaweeds at a slower rate than China and the rest of Asia (Msuya, et al., 2020). This paper focuses on examining critical business possibilities,

Only the coastal populations of Asian nations directly use edible seaweeds as food. A small number of research evaluated the impact and consumer acceptance of using seaweed as a functional component in food fortification. Thus, there is a lot of room to create functional diets that incorporate seaweed to stop certain illnesses in living things. When creating meals for those with stomach issues, seaweeds can be utilized as a natural supply of nutritional fiber and minerals. Foods containing seaweed can also be used to alleviate malnutrition in low-income people worldwide (Pandey, 2020), following research that the Development strategy of seaweed aquaculture agribusiness to increase production can be concluded that the opportunities were still open, therefore the development concept is directed towards realizing business opportunities, improving the quality and quantity of seaweed production, and creating new markets (Rahmawati, et al., 2024).

Since ancient times, seaweed, often referred to as marine algae, has been a staple of animal feed in coastal regions. Because seaweeds can harm animals when eaten by themselves, they are combined with animal feed. As a result, it is abundant in minerals (iodine, zinc, salt, calcium, manganese, iron, and selenium) and beneficial metabolites (pigments, carotenoids, phlorotannins, polyunsaturated fatty acids, agar, alginate, and carrageenan) (Morais, et al., 2020).

The purpose of this study was to create a commercial development plan for seaweed farming that had not yet reached its full potential (Pratama, et al., 2021). Seaweed is one of the living resources found in coastal and marine areas. It is a good source of soluble fiber. It also contains omega-3 fatty acids, potassium, and antioxidants that are beneficial for heart health. Several studies indicated that the nutritional content in seaweed could lower blood pressure, reduce bad cholesterol (LDL), and total cholesterol, as well as prevent blood clotting.

Seaweed is one of the marine biota with a diversity of species in Indonesia. Seaweed is used as a food ingredient, is a raw material used in building, medicine, cosmetics, cookery, and pharmaceuticals. One of the high-quality goods that makes Indonesia one of the world's top producers of marine fishery products in 2020 is seaweed (Akil, 2017).

Efforts to increase fish production can be made through aquaculture, both on land and at sea. Seaweed cultivation is a type of aquaculture in the fisheries sector that has great opportunities in eastern Indonesian waters. seaweed is the main commodity in the marine and fisheries revitalization program besides shrimp and tuna. It has several advantages, including wide open export opportunities, relatively stable prices, no seaweed trade quotas, and simple cultivation technology, so it is easy to master a relatively short cultivation cycle, so it provides quick profits, and relatively small capital requirements. (Nuryanto, et al., 2016).

In the Indonesian province of South Sulawesi, seaweed production is expanding quickly. In particular, seaweed Kappapycus alvarezi, also known by its commercial name Euchema cottoni, is highly valued as a culinary component and raw material for the carrageenan industry. A better seaweed business structure is required to fulfill the demand for seaweed production, which is positively impacted by the growing usage of seaweed extract (Buchholz, et al., 2012).

One of the centers for the development of seaweed cultivation in South Sulawesi is in Bone Regency. Bone Regency has a coastline of 138 km that stretches from North to South on the coast of Bone Bay. Bone Regency is a potential seaweed-producing area, However, in reality, a number of challenges remain, ranging from the choice of land, seeds, pests and diseases, institutions, inadequate funding, marketing, and processing. In addition, the constraints in the seaweed cultivation business include fluctuations in the price of seaweed at the farm level, the quality of the seaweed produced by farmers does not match the demand for the export market, the productivity of seaweed fluctuates, and the facilities and infrastructure that are not yet optimal at planting and post-harvest times.

The development of seaweed cultivation businesses cannot be separated from the role of stakeholders in East Lombok Regency. Three main stakeholders play a significant role: government agencies, the private sector, and communities. The government can create a conducive business climate, the private sector can contribute to job creation, and the community plays a role in every economic, social, and political activity. The community's perception of seaweed cultivation efforts and the level of stakeholder participation in seaweed business development are very interesting to study because active stakeholder participation can enhance seaweed cultivation efforts (Lathifatul, et al., 2019).

From the supply of production facilities and cultivation to seaweed sale, farmers' seaweed farming necessitates the integration of subsystems. Related parties can work together to accomplish this. Increasing the intensity of seaweed cultivation is one way to boost seaweed yield. This effort is carried out by increasing community participation (seaweed farmers) through a group approach system. The group approach is considered an efficient and effective way to increase the human resources of seaweed cultivators because farmer groups can function as learning classes, collaboration vehicles, and production units.

The seaweed cultivation business in East Lombok Regency is one of the fisheries enterprises with the potential to apply the principles of the blue economy. It is done by diversifying seaweed products to be processed into derivative products such as candies and chips. The application of the blue economy principle is carried out by introducing seaweed processing technology to produce high-value economic products. Additionally, the development of marketing networks for processed products is undertaken. Product diversification and market opportunities can create more job opportunities (Achmad, et al., 2018).

The research aimed to determine the feasibility of seaweed cultivation businesses and to formulate appropriate development strategies in seaweed cultivation (Yanti, et al., 2020). For this reason, it is necessary to carry out an assessment of the business scale and factors of seaweed production and to develop a strategy for fostering seaweed business. It is anticipated that the research findings would provide the community with suggestions for the best use of production parameters, enabling seaweed growers to maximize profitability and boost seaweed output. Furthermore, the research aims to determine the feasibility of seaweed cultivation.

2. Literature Review

2.1. Methods of Business Analytics

Prescriptive, diagnostic, predictive, and descriptive analytics are some of the methods used in business analytics.

2.1.1 Analytical Descriptives

The first phase in data analysis is descriptive analytics, which summarizes raw data to provide a thorough picture (Isah, et al., 2019). This tactic makes use of a suite. identifying patterns and trends through the use of statistical measures such as mean, median, mode, variance, and standard deviation. fundamental patterns in datasets. Descriptive analytics offers an overview of the state of circumstances at the moment. gives decision-makers the fundamental knowledge they need to comprehend, evaluate, and put their data in perspective. (Israel & Berman, 2022). In data analysis, the mean, median, and mode are examples of central tendency metrics. The mean is a numerical representation of a dataset's center position, calculated by averaging all values. The median is a reliable metric for datasets containing outliers since it takes into account the intermediate value and is not affected by extremes. The value that appears the most frequently in a dataset is called the mode, and it is especially important for categorical or discrete data. Higher variance highlights the degree of volatility or stability and denotes greater dispersion. Variance is the degree to which data points deviate from the mean. The average departure of data points from the mean is represented by the standard deviation, sometimes referred to as the square root of variance, which facilitates evaluation. Greater homogeneity is indicated by a smaller standard deviation, whereas greater variability is indicated by a larger one.

The descriptive analysis uses a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis to analyze the development of the seaweed cultivation business in Bone Regency. SWOT analysis i.e., strengths and weaknesses as well as external factors, namely opportunities and opportunities. The SWOT matrix was an important matching tool to help managers develop four strategies (Angriani, et al., 2021). The four strategies in question were presented as follows:

a. Strategi SO (Strengths - Opportunities). Strategies use the company's internal strengths to take advantage of external opportunities; typically, businesses attempt to develop a WO, ST, or WT strategy in order to implement an SO strategy. Thus, if the business has a lot of drawbacks.
b. WO Strategy (Weaknesses - Opportunities). This strategy aims to minimize the company's internal weaknesses by taking advantage of external opportunities.
c. Strategi ST (Strengths - Threats). This strategy aims to avoid or reduce the impact of external threats.
d. Strategi WT (Weaknesses - Threats)

2.1.2 Diagnostic analytics

Beyond descriptive analytics, diagnostic analytics helps to comprehend the underlying causes of observed patterns and abnormalities. Using advanced approaches, such as data Diagnostic analytics employs mining and statistical modeling to identify the underlying reasons for certain results and Variations in a dataset (Rea, et al., 2023). Large datasets are analyzed using diagnostic analytics to find trends, correlations, and patterns. This approach reveals hitherto unidentified connections and aids in identifying the causes of observed events. Similar to regression analysis, statistical modeling assesses the influence of variables on discernible patterns. This method assists businesses in determining the fundamental causes of certain results, such as fluctuations in business sales and readmissions of patients in the healthcare industry. Businesses may make more informed and proactive decisions by employing diagnostic analytics to better understand the reasons in their data.

2.1.3 Predictive analytics.

A cutting-edge tool for data-driven decision-making, predictive analytics gives businesses a forward-looking viewpoint by utilizing historical data. Predictive analytics helps businesses successfully navigate the complexities of a constantly shifting industry by going beyond the traditional paradigms of hindsight-driven insights (Hamza, 2023). Predictive analytics digs deeply into statistics to uncover intricate patterns using sophisticated methods like regression analysis and machine learning algorithms. Relationships may be invisible to untrained sight. An instrument for statistical decision-making is regression analysis. Investigate the relationship between one or more dependent variables using science, economics, and other fields. Independent variables. This method is useful for forecasting and modeling variable behavior by analyzing the relationship between changes in independent and dependent variables.

2.1.4 Prescriptive analytics

The best tool for data-driven decision-making is prescriptive analytics, providing firms with actionable insights and optimum tactics that go beyond prediction. By utilizing modern technologies like optimization modeling. Prescriptive analytics, like simulation, evaluates several possibilities and recommends the best course of action. Through advanced simulations, businesses may analyze the possible implications of alternative initiatives, allowing Them can make educated judgments that coincide with their goals. This proactive strategy improves operational efficiency and helps organizations manage difficulties with accuracy. Prescriptive analytics helps firms reduce risks and capitalize on possibilities for long-term success. obtaining a competitive edge in the ever-changing industry. Prescriptive analytics becomes a strategic ally as firms navigate the dynamic and constantly shifting landscape, guiding them to make strategic decisions that not only mitigate weather unpredictability but also contribute to long-term success (Sharda, et al., 2018).

2.2. Seaweed Farming Business

A survey was conducted in seven districts. 208 randomly chosen farmers received questionnaires as part of the data-gathering process, which also included purposeful sampling for key informant interviews and focus group discussions. In settlements with few farmers, the snowball method was used. The results showed significant obstacles that influence farmers' choices to stop or carry on seaweed cultivation. Recommendations for successful seaweed farming in Tanzania were provided, acknowledging the difficulties faced by women, including poor funding, theft, and a lack of transportation options (Rubekie & Bwathondi, 2022). At the same time, seaweed is becoming much more and more popular worldwide. Enhancing seaweed production's climate change adaptability is essential for farmers who depend on it for revenue and to boost their own climate change resilience. This paper examines seaweed farmers' long-term resilience capacity to adjust to one of the most significant threats: illnesses affecting seaweed harvests, using qualitative data from key informant interviews in four seaweed-producing regions in Tanzania. While several policies help farmers maintain their revenue, most of them only temporarily increase resilience.

Short-term resilience provides an opportunity for increased demand for marine resources, as well as a lack of legislation to encourage an egalitarian and sustainable mariculture sector based on seaweed, does not bode well for farmers' long-term ability to adapt to environmental degradation and climate change. For Tanzania's impoverished coastal people, seaweed harvesting remains a crucial source of revenue, but it no longer significantly improves their socioeconomic circumstances. Policies that support sustainable aquaculture must address the social, economic, and information gaps that prevent the poor from becoming resilient, especially in tropical regions that are most vulnerable to climate change (Matoju, et al., 2022), followed In most impoverished nations, women make up the vast majority of seaweed farmers. Their noteworthy impact on the industry has been extensively demonstrated and examined via case studies and successful instances. For over four decades, these seaweed ladies' have made enormous contributions to the sustainability of seaweed farming, and their devotion, patience, and perseverance demonstrate fortitude in the face of adversity. Women have a variety of responsibilities, including hands-on farming and small-scale processing, to turn the biomass from the seaweed into products of additional value. We investigate the position of women in the Western Indian Ocean (WIO) seaweed aquaculture, which includes Africa and India) and South-East Asia. In South-East Asia, men and women are nearly equally represented at all levels of the seaweed industry, but in Africa, women outnumber men in employment and their occupations are more varied. In contrast to the WIO region, All working-age family members, whether they are nuclear or extended, are employed by family-owned businesses that engage in seaweed farming in Southeast Asia. They have been and still are the backbone of the seaweed farming industry, as illustrated by five case studies of particular women. The family members' quality of life has improved favorably and beneficially as a consequence of the economic benefits of seaweed farming in both locations (for example, food, housing, clothes, health care, and social acceptability). The case studies show that women's dedication is what propels the seaweed industry and adds value to seaweeds, especially in the WIO. Since mothers are crucial family anchors in many developing countries, the benefits of having these women in charge of the seaweed industry will continue to benefit whole families as well as other community members (Msuya & Hurtado, 2017),

3. Method

3.1 Area, Design and Data

The research area was conducted from September to November 2022. In the following data using secondary data This research was conducted in Bone Regency. The northern boundary of Bone Regency borders Wajo and Soppeng Regencies, the South borders Sinjai and Gowa Regencies, the West borders Maros, Pangkep, and Barru Regencies, and the East borders Bone Bay. A map of the Bone County area can be seen in *Fig. 1*.

Figure 1*. Map of Bone Regency, South Sulawesi*

Research design

Because the subject of the study was in Bone Regency, the location was chosen with purpose. 150 respondents participated in this study, which focused on seaweed farming in Bone Regency. Primary and secondary data were the types and sources of data used in this investigation. Seaweed farmers in the field provided primary data, whereas previously completed data collection and the recording and distribution of evaluation results provided secondary data.

Research procedures

The research steps were as follows: 1) Defining the research objectives: The objectives, we want to achieve must be determined; if this is not done, we will have difficulty moving on to the next steps. 2) Research design: In the research process, we determined the design, which need to be done so that we can know what data to include in the design. 3) Sampling: The sampling technique was performed after determining the design to be used, as well as searching for references and obtaining ideas in the research process. 4) Data collection: During the data collection process, we will gather the required data. The technique used was very helpful based on references. 5) Data analysis: The next stage after gathering the required data was to determine whether or not it was required. Data analysis was essential as failure to do so may result in inaccurate information. 6) Reporting and conclusion: Following the presentation and analysis of the data, inferences were made from all of the information gathered. After that, a report was prepared and the findings were shared with the appropriate parties for further information or for other team members to double-check the data for approval.

Variable observed

The data of observation included: data collection method (observation, interview, literature review) Observation: Used to gather data on current seaweed farming practices, including Characteristics of the respondents used in this study were classified based on gender, age, occupation, and education, other data that were observed were: Source of capital (Fixed cost, Variable cost, Total cost), Production and Revenue, Income (Production Value (Receipts), Fixed cost, Variable Cost. The next data observed is Determining the Internal Strategic Factors Analysis Summary (IFAS) and Internal Strategic Factors Analysis Summary (EFAS) matrices. In qualitative research, In this study, the informants were seaweed farmers as for data for Interviews, We conducted interviews with the seaweed farmers one by one, there were certain criteria that respondents must meet, namely, being honest, adhering to regulations, keeping promises, being active and responsive, having opinions that align with the research, and understanding the research topic: Conducted with 20 seaweed farmers in November 2022 to understand perceptions of challenges, income level, because the purpose of the interview was to confirm the data and to find specific findings we had obtained based on the questionnaire: Interview data looking for specific findings includes into the quality of seaweed, investment value, business operating costs, guidance, and mentoring, Standard Operating Procedures (SOPs), Number of productions, worker welfare. This data informed the SWOT analysis and description of current challenges, In this research, validity and reliability tests have been carried out with Reliability Statistics results: 0.781 Mean Corrected Item-Total Correlation: 0.692. Literature Review: Used to understand the broader context of seaweed farming and explore existing business models, This informed the introduction, literature review, and discussion of best practices.

Secondary data

We searched for and found secondary data, namely including: Map of Bone Regency (South Sulawesi), Production of seaweed in 2022, Income/benefits of seaweed cultivation in 2022,

Data Survey/Regression

We searched for data to carry out data regression, the data we found included Age, Education, The number of relatives, and Experience in business which is regressed with the included data: Land Ownership, Farming Commodities, Mastery of Tools and Machines, Use of Labor, Use of Production Facilities, Use of Capital. Other variables included independent variables and dependent variables. Independent variables are those that are not influenced by other variables and have an impact on other variables. Dependent variables, on the other hand, were influenced by the independent variables. Dependent variables were considered to be the affected variables and were typically found at the end of the research title.

Statistical analysis

The statistical analysis used involved collecting and analyzing data to identify patterns and eliminate bias through numerical analysis and research interpolation, as well as organizing surveys and studies. The statistical analysis applied was regression, The logit model is the model that may be applied to ordinal logistic regression. A cumulative logit model is the logit model. The cumulative logit model is a model that is produced by comparing the cumulative probability, and in this logit model, the ordinal character of the answer Y is conveyed in the cumulative probability. One statistical technique for describing the connection between a response variable (Y) and several predictor variables (X) is ordinal logistic regression analysis, where the response variable falls into one of two categories and the measurement scale is level.

$$\pi(x) = \frac{e^{g(x)}}{1 + e^{g(x)}}$$

Cumulative odds are defined as follows:

$$P(Y \leq j \mid x_i) = \frac{\exp\left(\alpha_j + \sum_{k=1}^{p} \beta_k x_{ik}\right)}{1 + \exp\left(\alpha_j + \sum_{k=1}^{p} \beta_k x_{ik}\right)}, i = 1,2,3, \ldots, n$$

The following are the general logistics distribution functions:

$$F(x) = \frac{1}{1 + e^{-x}} = \frac{e^{x}}{1 + e^{x}}$$

Maximum Likelihood method Estimator) is the method used for estimating the parameters of the logistic regression model that is, it provides an estimated value **β** with maximize the likelihood function. If there is n random sample, then the Likelihood function is defined as:

$$l(\beta) = \prod_{i=1}^{n} [\phi_0(x_i)^{y_{0i}} \phi_1(x_i)^{y_{ii}} \phi_2(x_i)^{y_{2i}}], i = 1,2, \ldots, n$$

y_{ji}: Response value of the *j* category on the *i* observation

Øj (Xi): the probability of the *j* category on the *I* observation, I = 1,2, …, n, j= 0,1,2

from the equation above, the ln-likelihood function is obtained as follows:

$$L(\beta) = \sum_{i=1}^{N} y_{0i} \ln [\phi_0(x_i)] + y_{1i} \ln [\phi_1(x_i)] + y_{2i} \ln [\phi_2(x_i)]$$

Then, maximize ln-Likelihood with differentiate L (β) to (β) and equals zero. To estimate variance and covariance of the estimated values β which is the second derivative of the ln-Likelihood function, then it is used Newton Raphson's iteration. Newton's iterative formulation Raphson is

$$\beta^{(t+1)} = \beta^{(t)} - \left(H^{(t)}\right)^{-1} q^{(t)} [4]$$

According to Hosmer and Lameshow (2000), the model has significance and needs to be tested by carrying out statistical testing. The tests carried out are:

Simultaneous Test Simultaneous tests were carried out to check the significance coefficient β as a whole.

Hypothesis:

$H_0 : \beta_1 = \beta_2 \ldots\ldots = \beta_j = 0$

H_1 : there is at least one $\beta_{j \neq} 0, j = 1,2,\ldots\ldots, p$

Statistical Test

$$G = -2\log\left[\frac{\left(\frac{n_0}{n}\right)^{n_0}\left(\frac{n_1}{n}\right)^{n_1}\left(\frac{n_2}{n}\right)^{n_2}}{\prod_{i=1}^{n}[\phi_0(x_i)^{y_{0i}}\phi_1(x_i)^{y_{1i}}\phi_2(x_i)^{y_{2i}}]}\right]$$

Explanation

$$n_0 = \sum_{i=1}^{n} y_{0i}, n_1 = \sum_{i=1}^{n} y_{ij}, n_2 = \sum_{i=1}^{n} y_{2i}, \text{and} = n_0 + n_1 + n_2$$

Db = (number of categories-1)= 2

H_o: when Ho is rejected at a significant level of mark α if p-value < α or $G > X^2_{a.db}$

Partial tests are used to check the significance coefficient β individually.

Hipotesis: $H_0: \beta_j = 0, j = 1,2, \dots, p$

$H_1: \beta_j \neq 0$

Statistical Test

$$W_j = \frac{\hat{\beta}_j}{SE(\hat{\beta}_j)} \square N(0,1)$$

H_o is rejected if $| W_j | > Z_{a/2}$ or value p value < α, where Z denotes the value random variable in the standard normal distribution table. The independence test is carried out to find out if there is whether or not there is a relationship between the response variables with predictor variables. Testing is carried out using the Chi-square test, It was used to investigate the correlation between independent and dependent variables. The data was utilized to predict the dependent variable, examining how one variable affects another or how changes in one result were inconsistent with changes in another, with outcomes depending on one or more factors.

SWOT Analysis

The overview of the Bone Regency was examined using secondary data from the Bone Regency's Central Statistics Agency in 2022. A pH meter, water thermometer, current meter, Secchi disk, and refractory salinity were used to measure water quality characteristics such as pH, temperature, current speed, brightness, and salinity. A SWOT analysis is used in the qualitative descriptive study to examine how the seaweed farming industry in Bone Regency has developed. Strengths, Weaknesses, Opportunities, and Threats, or SWOT analysis, includes both internal and external factors, such as opportunities and weaknesses. Managers were able to create four strategies with the use of the SWOT matrix (Angriani et al., 2021). The following were the four techniques that were being evaluated:

a. Strategy SO (Strengths - Opportunities). Strategies use the company's internal strengths to seize opportunities that exist outside the company, generally, companies try to implement a WO, ST, or WT strategy to implement an SO strategy. Therefore, if the company has many disadvantages.
b. WO Strategy (Weaknesses - Opportunities). This strategy aims to minimize the company's internal weaknesses by taking advantage of external opportunities.
c. Strategi ST (Strengths - Threats). This strategy aims to avoid or reduce the impact of external threats.
d. Strategi WT (Weaknesses - Threats)

Reducing internal weaknesses and avoiding corporate dangers were the two main strategies used to survive. Companies that confronted several internal vulnerabilities and external threats were essentially in a precarious situation. To identify the external (opportunities and threats) and internal (strengths and weaknesses) elements influencing the development of human resources, a SWOT analysis was employed.

From the SWOT analysis, a crucial tool for understanding strengths, weaknesses, opportunities, and threats faced, effective and sustainable business strategies can be developed. SWOT analysis in seaweed farming business development: (1)Strengths: Most businesses have their land ownership, which is a strength for seaweed farmers to increase production, thus fostering confidence in collaboration with stakeholders in the seaweed industry. The high

interest of farmers in seaweed cultivation makes it easier to partner with entrepreneurs or investors. There is good cooperation between seaweed farmers and the government/local government. (2) Weaknesses: There is still a lack of awareness among seaweed farmers about repaying business loans from the government, as they perceive government aid as free assistance. Seaweed farmers often lack the capital to borrow from middlemen, resulting in payments being deducted from the price or selling below the standard price. The quality of seaweed is often manipulated by dishonest middlemen, such as mixing materials to increase weight. There is a shortage of quality seeds for cultivation, making it difficult for seaweed farmers to obtain good seeds. (3) Opportunities: Government policies that rely on seaweed as a flagship commodity and designate Bone Regency as a seaweed processing center. Government partnerships through the Department of Marine Affairs and Fisheries to enhance and develop the fisheries sector, particularly the seaweed commodity, present a significant opportunity to increase production. (4) Threats: The Bone Regency government does not function effectively in controlling partnerships with seaweed farmers. The government does not guarantee or facilitate seaweed marketing, leaving it in the hands of middlemen who sometimes manipulate seaweed prices at the farmer level. Price manipulation by middlemen has not been optimally addressed. Stakeholder roles are not centralized in a single system to collaborate in increasing seaweed production.

The aim of this study was to use the scientific approach to determine the self-life of seaweed Dodol, which was produced on a conventional scale (micro, small, and middle-size company). One technique for figuring out how long seaweed will last on the shelf is called Accelerated Shelf Life Testing (ASLT) (Latief, et al., 2019). The research method was descriptive research, which will be carried out using a questionnaire survey to consumers using convenience sampling on their perceptions of innovative products based on seaweed biotechnology in Indonesia (Sultan, et al., 2022). The research includes identifying key goals for company assistance and development under current conditions. The authors provide a novel technique to estimate company development and optimize investment allocation, logistical and human resources, and the effectiveness of calculations of production plans and programs (Tetyana, et al., 2023). This investigation aims to identify the institutional conditions available and the strategies of the community in case of institutional infrastructure limitations in the development of farming seaweed. The type of the data being used was the primary and secondary data. Data analysis used the method of analysis tabulations and descriptive (Hidayat, et al., 2022). Another research discovered that firms with higher ESG ratings beat companies with lower Environmental, Social, and Governance (ESG) scores in terms of stock performance under economic instability. Furthermore, when the ESG framework is broken down into its separate pieces, the social component proves to be the most crucial feature (Ashutosh, Y, 2022). confirmed by other research These results demonstrate the varying stability and dynamism of businesses in the face of technical and economic shifts. Due to its focus on Scottish businesses, the study might not accurately represent trends in other regions. Comparing global trends or using machine learning-based analysis for regression and future probabilistic projections are two other areas of investigation. Policymakers and corporate strategists may benefit from the insights, which help with strategic planning and well-informed decision-making for long-term company growth. Understanding the sustainability of company activities is crucial in the present socioeconomic environment, and the research helps with that. Using novel statistical techniques, this work adds to the discussion in business administration by offering a distinctive perspective on how to run sustainable businesses during significant global economic upheavals (Mustafa, 2024). The UTARI cooperative can implement the techniques to create innovative processed seaweed products in Bulukumba. Increasing cooperation between UTARI cooperatives and stakeholders, enhancing the marketing system via social media and digital marketing, hiring more staff or UTARI cooperative members, and producing processed grass sea goods as unique souvenirs in Bulukumba (Busthanul, et al., 2023).

Seaweed farming is one of the main sources of national economic support and has significant economic significance for the economic growth of the community. As a result, farmers may adapt to technological cultivation more easily. Furthermore, seaweed commodities account for 80% of Southeast Sulawesi's fisheries output (Geo & Ariani, 2019). According to the research design that has been constructed before. This research was conducted using the case study method. The data approach is carried out by qualitative methods. Qualitative data collection was carried out by conducting interviews with purposive sampling and choosing the stakeholders related to the company representatives to find out about the product innovation management efforts that have been carried out (Archie & Sudrajati, 2023).

The kind and source of data to be obtained have an impact on the data-gathering methods. Consequently, the method of data collecting used in this study was questionnaire-based interviews. Interviews were conducted with 100

respondents. Of the 100 respondents, 30 of them were willing to provide complete data for business analysis purposes.

4. Analysis and Discussions

4.1 Characteristics of the respondents

Table 1 displays the grass cultivator's identification, including age, educational attainment, number of dependents, and experience in the cultivation industry.

Table 1. Characteristics of the respondents

No	Variables	Mean±SD
1	Age (years)	61 ± 2,21
2	Education (Years)	6 ±1,71
3	The amount of family members (person)	4 ± 1,82
4	Experience in business (years)	8 ± 2,81

Source: Primary Data, 2022.

Based on Table 1 knows that the seaweed cultivators were at a productive age of 41 years. The Central Statistics Agency (2011) outlined how the age distribution of the population was divided into three groups according to its composition: 0–14 years old, or unproductive age; 15–64 years old, or adult/working age; and 65 years old, or unproductive age.

4.2 Ordinal Regression Analysis of The State of Seaweed Farming

Table 2 Model Fitting Information

	Model	-2 Log Likelihood	Chi-Square	df	Sig.
Land Ownership	Intercept Only	157.677			
	Final	85.519	72.158	45	.006
Farming Commodities	Intercept Only	156.893			
	Final	71.882	85.010	45	.000
Mastery of Tools and Machines	Intercept Only	156.893			
	Final	71.882	85.010	45	.000
Use of Labor	Intercept Only	156.496			
	Final	63.901	92.595	45	.000
Use of Production Facilities	Intercept Only	142.797			
	Final	80.027	62.769	45	.041
Use of Capital	Intercept Only	159.806			
	Final	95.573	64.233	45	.031

Source: Primary Data, 2022. Age, Education, The amount of family members, Experience in business
Link function: Logit; Independent :

Table 2. Based on ordinal regression analysis with the independent variable namely Age and education, The dependent variable is significantly impacted by the number of family members and business experience. The independent variable gives a considerable effect concurrently in affecting the dependent Land Ownership variable with a value (0.006), The independent variable provides a significant influence simultaneously in influencing the dependent Farming Commodities variable with a value (0.000), The independent variable provides a significant influence simultaneously in influencing the dependent Mastery of Tools and Machines variable with value (0.000), The independent variable provides a significant influence simultaneously in influencing the dependent Use of Labor variable with value (0.000), The independent variable provides a significant influence simultaneously in influencing the dependent Use of Production Facilities variable with value (0.041), The independent variable provides a significant influence simultaneously in influencing the dependent Use of Capital variable with value (0.031).

4.3 Analysis of Seaweed Cultivation Income

Cost analysis of work using production/machinery equipment/cultivars in the seaweed processing, as shown in Table 3.

***Table 3**. Table of seaweed cultivation costs in 2022*

No.	Equipment Name/ Ingredient	Value (IDR)	Shrinkage
1.	Fixed cost		
	Main rope	100,000	15,625
	Stretch rope	285,000	356,256
	Strap	65,000	8,125
	Boat	6,000,000	125,000
	Anchor	570,000	7,125
	Ketinting machine	4,000,000	66,666
	Tarpaulin	125,000	31,250
Total fixed cost			289,416
2.	Variable cost		
	Seeds	3,815,000	
	Labor	1,4,31,667	
Total variable cost			5,246,667
Total cost of seaweed cultivation (IDR)			5,536,083

Source: Primary Data, 2022

4.4 Source of capital

Fixed cost

Fixed costs are costs that are used for a long period or costs whose amount does not depend on changes in the amount of production by seaweed cultivators. Fixed costs included depreciation costs for durable equipment and land tax. The total fixed costs used in seaweed cultivation were 289,416 IDR.

Variable cost

Variable costs are costs whose amount varies according to the amount of production incurred by seaweed cultivators during cultivation activities and affect the resulting production. Variable costs included the cost of production facilities used, transportation, and fuel costs. Table 5 shows that seaweed cultivation with 1 ton of seed required 5,246,667 IDR of variable costs consisting of seeds and labor to tie ropes to be installed at sea.

Total cost

Total costs are all costs incurred by seaweed cultivators by adding up the fixed costs and variable costs. Table 5 shows that the total production costs incurred for the cultivation of seaweed used by the respondents were 5,503,917 IDR.

Production and Revenue

The production value was the amount of revenue obtained from sales at the prevailing price level in conducting seaweed cultivation. Seaweed production in 2022 can be seen in Table 4.

***Table 4**. Production of seaweed in 2022*

No	**Fee Type**	**Amount (IDR)**
1.	Production price	472,5
2.	Production value (receipt)	14,000/kg
3	Revenue (IDR) / Production Cycle	6,601,000

Source: Secondary Data, 2022.

Table 4 shows the level of seaweed cultivation with 472.5 kg and the price was 14,000/kg. So the production value was 6,601,000 IDR during the production cycle.

Income

Income is the amount of income earned by seaweed cultivators from the difference between the amount of production value and the amount of production costs. Income/benefits can be seen in Table 5.

Table 5*. Income/benefits of seaweed cultivation in 2022*

Source:

No.	Fee Type	Total (IDR)
1.	Production Value (Receipts)	6,601,000
2.	Fixed cost	289,416
3.	Variable Cost	5,246,667
Income		1,064,917

Secondary Data, 2022

Table 5 shows that the average income obtained from the cultivation of seaweed with 1 ton of seeds, cultivators get 1,064,917 IDR of profit.

To determine the magnitude of the R/C ratio obtained by seaweed cultivators on seaweed cultivators is presented in Table 6.

Table 6*. Seaweed production in 2022*

Revenue (IDR/production cycle	Production cost	R/C ratio
6,601,000	5,536,083	1.19

Source: Secondary Data, 2022

Table 6 shows that the R/C obtained from seaweed cultivation was 1.19, meaning that every time you spend 1,00 IDR, you will produce 1,19 IDR of output (classified as a profitable category).

Determining the Internal Strategic Factors Analysis Summary (IFAS) and EFAS matrices can be seen in Tables 7 and 8.

Table 7*. Matrix IFAS*

	Internal Strategy Factors	Weight	Rating	Weights X Rating
A	Strength			
1	Sustainable availability of rawmaterials	0.20	4	0.8
2	Simple production process	0.20	3	0.6
	Total	0.40		0.14
	External Strategy Factors	**Weight**	**Rating**	**Weights X Rating**
B	Debilitation			
1	Seaweed quality	0.10	4	0.4
2	High investment value	0.05	2	0.1
3	High business operating costs	0.05	2	0.1
4	No guidance and mentoring	0.20	4	0.8
5	Don't have an SOP	0.05	1	0.05
6	Limited production quantity	0.05	2	0.1
	Total	0.60		1.55

Source: Primary Data, 2022.

***Table 8**. Matrix EFAS*

	External Strategy Factors	Weigh t	Rating	Weights xRating
A	Opportunity			
1	Training assistance and business assistance	0.20	4	0.8
2	Adequate marketing infrastructure and facilitiesare available	0.10	3	0.3
3	Great market opportunity	0.20	4	0.8
	Total	0.50		1.9
	External Strategy Factors	Weight	Rating	Weights x Rating
B	Threat			
1	Institutional capital is lacking	0.25	2	0.5
2	Fluctuating raw materialprices	0.25	3	0.75
	Total	0.50		1.25

Source: Primary Data, 2022

Based on the scoring results on the IFAS and EFAS matrices above, it can be seen that the internal strength factor (S) had a value of 0.14 and a weakness value (W) of 1.55. The results of the EFAS matrix analysis show that the opportunity factor (O) has a large value of 1.9 compared to the threat value (T) which was 1.25. There were the coordinate points (X, Y) on the SWOT diagram (*Fig. 2*).

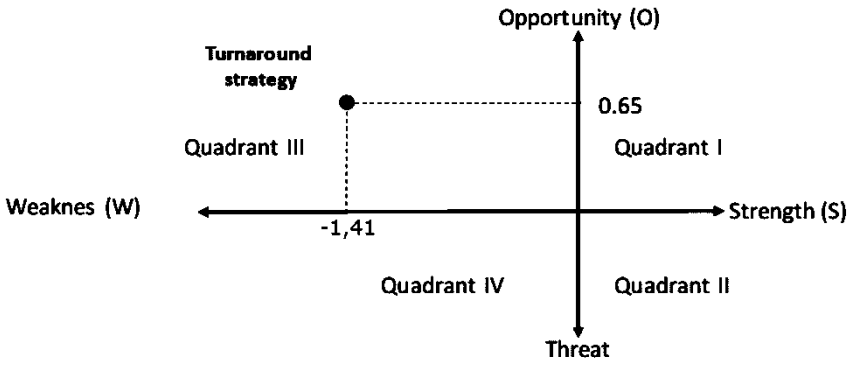

***Figure 2**. IFAS and EFAS Diagram*

IFAS matrix value = total strength – total weaknesses

= 0.14 – 1.55

= - 1.41

EFAS matrix value = total opportunities – total threats

= 1.90 – 1.25

= 0.65

The result of the chart value above states that the value is in quadrant III (negative, positive), which indicates a weak and likely policy. Quadrant III is a turnaround condition, which means that it minimizes internal problems such as making a better market. The priority of featured strategies can also be calculated in Table 9.

Table 9. *IFAS and EFAS matrix values*

IFAS EFAS	Strength (S) 0.14	Weakness (W) 1.55
Opportunity (O) 1.9	Strategy S – O (2.08)	Strategy W - O (3.45)
Threats (T) 1.25	Strategy S – T (2.75)	Strategy W – T (2.8)

Source: Primary Data, 2022

Based on the IFAS and EFAS matrix values, the highest value of 3.45 in the W – O (Weakness – Opportunities) strategy is as follows:

1) Utilizing training assistance and business assistance to improve the skills of seaweed resources and quality.
2) Optimization of marketing carrying capacity to increase revenue so that operational costs can be met.
3) Take advantage of broad market opportunities for guidance and assistance so that business groups have good SOPs and maximize the amount of production.

Seaweed growers have an education level of six years, which is considered poor. Education has a long-lasting impact on people's thoughts, behaviors, and generalizations about the circumstances they encounter. Limited access to education can impact the ability of seaweed farmers to adopt modern agricultural practices, access information and engage in agricultural activities. Therefore, additional knowledge and skills are needed for seaweed farmers to be able to manage seaweed cultivation properly in order to maximize output and revenue.

Seaweed growers' families are classified as medium households, meaning they have four dependents. According to the Central Statistics Agency, a family is considered small if it consists of one to three individuals, medium if it consists of four to six people, and big if it consists of more than six people. Therefore, the number of dependents of seaweed cultivators has the potential to act as a family workforce to support seaweed cultivation activities well for maximum production and income achievements.

Their experience in the seaweed cultivation business is 11 years and they are categorized as an experienced cultivator. Work experience partly has a significant effect on work productivity. The longer a cultivator manages his business, the more experience he gains, thus influencing the cultivator's attitude and actions to increase production and income.

The capital requirements to carry out seaweed cultivation operations vary depending on the amount of production that will be produced in seaweed cultivation. In addition, capital tends to be used repeatedly and can be used to buy materials/operational needs in the hope that it will return after production is sold. Capital can also be used again to buy materials for operational needs to be processed, then so that seaweed cultivators can continue with the investment costs made in seaweed cultivation.

Revenue cost ratio (R/C) analysis is an analysis that can determine whether the business is experiencing a loss, break-even, or profit. R/C analysis is a comparison between revenue and expenses incurred. If the R/C Ratio > 1, then seaweed cultivation is feasible or profitable, if R/C = 1, then seaweed cultivation is not profitable or unprofitable, if R/C < 1, then seaweed cultivation is not feasible or unprofitable. The results of the feasibility analysis in this study show that R/C = 1.2 means that seaweed cultivation is worth continuing because it is included in the profitable category.

Strategy of development using a SWOT analysis

Interview Details using a SWOT analysis: While the revision mentions interviewing seaweed farmers in November 2022, the informants were seaweed farmers as for data for Interviews, We conducted interviews with the seaweed farmers one by one, there were certain criteria that respondents must meet, namely, being honest, adhering to regulations, keeping promises, being active and responsive, having opinions that align with the research, and understanding the research topic such as : such as level of experience in marketing, size of farm, availability of land, The rationale for interviewing these particular farmers because by providing honest answers, it will represent the true picture so that there is follow-up on the problems faced by farmers, also with experience you can see skills, especially in managing income and expenditure, as well as marketing competencies that will also support income, Interviews were conducted in a semi-structured manner because the answers and responses from informants sometimes required repetition and emphasis on certain topics and required some clarification to facilitate prioritization of problems and appropriate follow-up recommendations. The data is in qualitative form using a SWOT (Strengths, Weaknesses, Opportunities, Threats) approach so that the interview topics are more focused according to the themes and strategic issue components

Based on the results of the study of the condition of the seaweed cultivation business in Bone Regency, it can be concluded that the strategic problems in theseaweed cultivation business include:

1) The quality of seaweed is low.
2) High investment value
3) High business operating costs
4) No guidance and mentoring
5) No Standard Operating Procedures (SOPs)
6) A limited number of productions
7) Low worker welfare

To find the right business development strategy, using a SWOT analysis, internal problems of seaweed cultivation businesses are used as factors of internal weakness. So, the following presents the results of the identification of internal and external factors seen in Table 10.

Table 10*. Identification of internal factors and external factors*

No.	Internal Factors	No.	External Factors
A	(Strength) **Capital** 1. Availability of raw materials in a sustainable manner 2. Simple production process	C	(Opportunity) 1. Assistance in mentoring and businesstraining 2. Adequate marketing infrastructureand facilities are available 3. Great market opportunity
B	(Weakness) **Price** 1. Low seaweed quality 2. High investment value 3. High business operating cost 3. Without guidance and mentoring 4. Without Standard Operating Procedures (SOP) 5. Limited production quantity	D	(Threats) **Price** 1. Institutional capital is lacking 2. Fluctuating raw material prices

Source: Primary Data, 2022

Based on the identification of internal and external factors above, the weakness factors will be made a strategy to overcome the weaknesses of the seaweed cultivation business in the SWOT analysis matrix (Table 11).

Table 11. *SWOT analysis matrix*

	Strength (S)	Weakness (W)
Internal / External	1. Sustainable availability of raw materials 2. Simple production process	1. Low seaweed quality 2. High investment value 3. High business operating costs 4. No guidance and mentoring 5. Don't have an SOP yet 6. Limited production quantity
Opportunity (O)	Strategy S – O	Strategy W – O
1. Training Assistance and business assistance 2. Adequate marketing infrastructure and facilities are available 3. Great market opportunity	1. Utilizing training andmentoring assistance to increase production so that production targets are achieved 2. Optimizing marketing infrastructure and facilities to increase revenue. 3. Expanding marketing so that sales targets are achieved	1. Utilizing training assistance and business assistance to improve the skills of seaweed resources and quality 2. Optimization of marketing carrying capacity to increase revenue so that operationalcosts can be met 3. Take advantage of broad market opportunities for guidance and assistance so thatbusiness groups have goodSOPs and maximize the amount of production.
Threat (T)	Strategy S – T	Strategy W - T
1. Fluctuating raw material prices 2. Institutional capital is lacking	1. Strengthen raw material inventory management to cope with volatile raw material prices. 2. Institutional optimization of capital in increasing income.	1. Establish partners with seaweedfarmers and suppliers in the availability of raw materials. 2. Strive for human resource development and training to increase knowledge about seaweed quality and increased production

Source: Primary Data,2022

Based on the SWOT matrix, it can be seen that several strategies can be carried out by the assisted groups of the District Marine and Fisheries Service to developtheir business in the face of competition in the future.

1). Strategy S – O (Strengths – Opportunities)

This strategy is structured using the strengths and opportunities it has. Some of the strategies taken include: a). Utilizing training and mentoring assistance to increase production so that productiontargets are achieved, b). Optimizing marketing infrastructure and facilities to increase revenue, and c). Expanding marketing so that sales targets are achieved.

2). Strategi S – T (Strength – Threats)

This strategy is carried out to utilize the strengths possessed to overcome thethreats faced. The strategies carried out were: a). Strengthen raw material inventory management to cope with volatile raw materialprices, and b). Institutional optimization of capital in increasing income.

3). Strategi W – O (Weakness – Opportunities)

This strategy is applied based on the utilization of existing opportunities, by overcomingthe darkness that is owned. The strategies that can be used are: a). Utilizing training assistance and business assistance to improve the skills of seaweedresources and quality, b). Optimization of marketing carrying capacity to increase revenue so that operationalcosts can be met, and c). Taking advantage of broad market opportunities for guidance and

assistance so thatbusiness groups have good SOPs and maximize the amount of production

4). Strategi W – T (Weakness – Threats)

This strategy to address weaknesses and threats must be addressed immediately. Toovercome can be taken the following strategies: a). Establish partners with seaweed farmers and suppliers in the availability of raw materials, and b). Strive for human resource development and training to increase knowledge aboutseaweed quality and production.

5. Conclusions

This study found that The variables Age, Education, Number of Family Members, Experience in business provide a fairly large influence simultaneously in influencing the dependent variable Land Ownership, including also providing a significant influence simultaneously in influencing the dependent variable Agricultural Commodities, it also provides a significant influence simultaneously in influencing the dependent variable Mastery of Tools and Machines, and provides a significant influence simultaneously in influencing the dependent variables Use of Labor, Use of Production Facilities, Use of Capital.

Apart from that it can be concluded the income level for seaweed farming was IDR 1,097,082 per production cycle. Seaweed farming was viable since the R/C ratio was 1.99, implying that every 1.00 spent generated 1.19. The chart's value was in quadrant III (negative, positive), indicating a weak and likely policy. We offer the finest techniques for improving the seaweed business, such as using training and business help to increase the skills and quality of seaweed resources. Optimizing marketing carrying capacity to raise income and cover operating costs, promoting items to a large market, and enhancing quality assurance. The independent variables, including age, education, number of family members, and business experience, have a considerable effect on the dependent variable. It provides a major concurrent impact on land ownership, farming commodities, mastery of tools and machines, use of labor, use of production facilities, and use of capital. Seaweed Cultivation is significantly influenced by the Number of Family Members and Business Experience.

The strategic conclusion in this study is that according to the SWOT analysis is that the S-O Strategy (Strengths-Opportunities):

This strategy is realized by utilizing training and mentoring assistance to increase production so that production targets are achieved, also realized by optimizing marketing infrastructure and facilities to increase revenue, and expanding marketing so that sales targets are achieved. While the S-T Strategy analysis (Strengths-Threats). shows that this strategy is realized by strengthening the management of raw material inventory to overcome fluctuating raw material prices, and optimizing capital institutions in increasing revenue. As for the W-O Strategy (Weakness-Opportunities). This strategy is realized by Utilizing training assistance and business mentoring to improve seaweed resource skills and quality, as well as Optimizing marketing support to increase income so that operational costs can be met, as well as in Utilizing broad market opportunities for coaching and mentoring so that business groups have good SOPs and maximize production volumes, in contrast to the W-T Strategy (Weakness-Threats). This strategy shows the importance of Establishing partnerships with seaweed farmers and suppliers in the availability of raw materials, as well as Striving for human resource development and training to improve knowledge about seaweed quality and production.

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