FISHERY SUPPORTING INDUSTRY PLANNING FOR KARIMUNJAWA JEPARA SEA FARMING

by Ratna Purwaningsih

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ABSTRACT

Mari culture is an alternative solutions for Overfishing on capture fisheries. Mari culture on Karimunjawa Jepara district has been developing marine sea farming for commodity of seaweed, grouper fish and shellfish. The problems encountered recently is lack off supporting Industry to supply fish seed, feed fish and marine sea farming equipment and tools. Also, the infrastructure for fish handling, processing and marketing still inadequate.
The development of marine sea farming industry requires government policy to encourage the emergence of supporting industries. As a huge investment needed, supporting industries can only be presented if the potential development of the sea farming industry is shown to have a high economic value. It is necessary to present an industry planning studies on marine sea farming. This paper aims to discuss (1) the type of supporting industry necessary, (2) the Interlinkage model between industry, and (3) estimate the number and size of industrial capacity based on available marine resources (land and water conditions). The research method was deep interviews, focus group discussions and a literature review. Result of the discussion would be useful to develop marine sea farming of Karimunjawa to become an industrial cluster which connected with the surrounding areas as supporting industries and market areas.

Keywords: marine sea farming, industrial planning, supporting industries

1. INTRODUCTION

Indonesia is a maritime country with a long coastline of 81,000 km. Indonesian coastline is very potential for marine sea farming. Indonesia aqua culture production by major commodities for 2014 reached almost 17 thousand Stones [1]. Sea farming continues to grow faster than capture fisheries, with the increase in the national average per year to reach 23, 6 percent since 2002, while the capture fishery is only 2, and 91 percent. Sea farming production in 2002 totaled 1.14 million tons with a value of Rp 14.37 trillion. For Central Java province, the potential of land that can be utilized by 677 hectares of the leading commodity snapper, grouper, sea cucumbers and seaweed [2].
FAO last review of the conditions of global fishery resources has conclude that the world's 523 species of fish stock assessment conducted, 52% of fish resources are already fully exploited, 17% overexploited and only 3% are underexploited [3]. Marine sea farming can be an alternative to increase the stock of fish and tackle overfishing. The existence of successful sea farming activities would indirectly divert the pressure of catching at sea so that sustainability can be maintained [4]. Sea farming is one of the efforts to overcome poverty by transforming the fishermen their livelihoods of fishers 'catch' to fisherman 'cultivation'. Fishing communities have difficulty on changed their profession because of the nature of economic, cultural, and low skill and Education [5]. However, if the income from the cultivation sector is higher than capture fisheries sector, the fisher would choose sea farming.

Overfished is threaten to protein food needs from fish products. Shifting from marine capture fisheries to sea farming today is a must. However, marine sea farming production costs are greater than capture fisheries. Thus, the commodity chosen must has a high economic value. Unfortunately, the types of high economic value of fish need habitat of life in the clean waters from pollution. Despite the north coast of Java are already polluted, Karimunjawa coast meet the specifications to be a clean water for grouper sea farming and seaweed [6].
Marine sea farming requires a wide range of supporting Industries such as hatchery, industrial fish feed, industrial medicine, industry providers cultivation equipment such as boats, net, fishing gear, Ice factory, the packaging industry, industry to produce tools for fresh fish handling, cold storage, fuel providers for small fishing boats, industrial handling distribution and marketing of products and providers of venture capital. Various supporting industries that have a role in shaping the selling price of marine sea farming products. Lack of planning capacity that meets the economies of scale will increase production costs. Some constraints in capacity planning as limitations of the technology, machine availability, raw materials availability for production will form the production capacity of the industry. Thus, the planning of the industry should use a holistic approach from the aspects of the market, production, and economic. Sea farming and its supporting industries is an interrelated production chain. Constraints of sea farming development in Indonesia [7] is yet inadequate amount (1) Technology provision of fish feed, feed farmed fish in floating net cages is trash

fish availability depends season, fish feed made in the form of pallet production is not sufficient, (2) Technology of production of fish seed has not been evenly distributed in each province, the availability of the number and variety of hatchery still not meet the needs of fish farmers, (3) Information on suitable sites for sea farming (zoning of coastal), (4) Industry advocates to provide specific means necessary in sea farming. An industrial capacity planning approach needed to estimate the volume of various facilities and raw materials as input for marine sea farming. Regional planning on sea farming development aims to prevent overinvestment. Exploitation will have an impact on the ecological damage and takes a long time to coastal ecosystems recovery damaged due to pollution caused by sea farming. A certain area of the coast should still work as a conservation area and protected from fisheries production activities

This paper aims to conduct a description of the condition of Karimunjawa Coast sea farming. An overview of these conditions is the basis to create a virtual model that helps support industry capacity planning in marine sea farming. The purpose of this study are (1) Develop a model of ecological and economic system of fisheries, the development model of fish growth rate and capacity of the environment and the need for inputs for cultivation, (2) Develop a model of industrial structure and planning support industry.

2. FRAMEWORK FOR DEVELOP SEA FARMING

Fisheries are all activities relating to the management and utilization of fish resources and the environment from pre - production, production, processing to marketing, implemented in a system of fishery business. Sea farming is an activity of producing fish in a container controlled and oriented to profit [8].

Sea farming is basically consists of three sub – systems (1) sub - input system, (2) sub - system Mari culture (process) and (3) sub - system output [9]. Review of various literature resulted on model framework for marine sea farming as shown in Figure 1. According to figure 1 sea farming development framework consist of phase three phase (1) mapping of coast area which potential for sea farming, (2) planning and developing the supporting industries, and (3) implementation the program. Sea Farming of Karimunjawa have not had adequate supporting industries and market access yet.

Fishery industry is defined as the industrial activity taking of fisheries, cultivation, processing, preservation, storage, distribution and marketing or sales of products processed from fish or fish (Fisheries Act 2004). Factors need to be considered before sea farming activity (1) the readiness of the seed to be stocked, whether from natural or mainly from the hatchery, (2) the selection of suitable waters, good environmental conditions (physical, chemical, biological, social) of aquatic ecosystems/beach and coastal, consisting of mangrove forests, seagrass beds (sea grass), and more to the middle again that coral (coral reef), also (3) types of commodities that are appropriate for the waters earlier.

Ahmad [7] said that requirements for sea farming program are (1) seed fish to be stocked no longer rely on nature, but can be supply from a hatchery, (2) types of fish have the nature habit close to the coast so that easily recaptured by fishermen. A good harvest will be obtained if the species density does not exceed the limit, so the number of fish depends on the availability of suitable land. Fish growth depend on the intrinsic characteristics of the cultivated species. Based on these two variables, we can estimate the amount of production, the need of hatchery, fish feed and equipment for aquaculture such as cages, floats, canoes, cold storage and other infrastructure needed. China is one of the countries that managed to develop marine aquaculture. There are various models of aquaculture systems (offshore cages) this marine fish that have been developed in the bamboo curtain country [10].

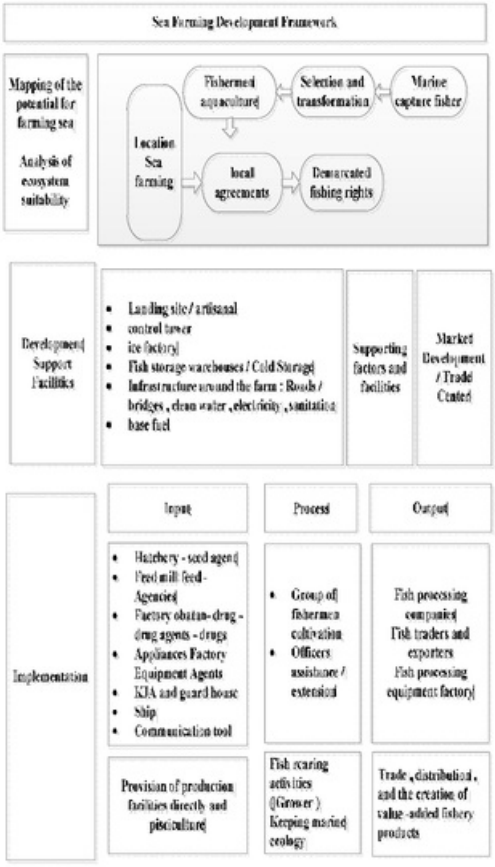

Figure 1. Method to create a Virtual model of Sea Farming

3. KARIMUNJAWA MARI CULTURE

The research location is Karimunjawa islands. Karimunjawa National Park is a group of 27 islands that has a type of lowland rain forest ecosystems, seagrass, algae, coastal forest, mangroves, and coral reefs. There are 27 islands, five of which have been uninhabited islands (island of Karimun, Kemujan, Parang, Mosquito, and Genting). Karimun islands at the center of districts within ± 83 km from the city of Jepara, Central Java. Karimun islands have an area of approximately 110,117 hectares with air temperature 23 ° - 32 ° C at an altitude of 0-605 meters above sea level. Some marine aquaculture commodities that have been cultivated here are seaweed, tiger grouper, hump back grouper and shellfish species [11].

Maximum use in land the availability will impact on the destruction of coastal environment. The Economic analysis on technical aspects should be done before reviewing economic benefit for the region. Thus, the Sea farming industry model should present fish rate of growth, input material, the length of time fish Boeing farmed because all of that activity determine the unit cost of fish farming. Rafter that, the industry structure is then mapped. Relationships among all industries is a value added chain. Then, we can estimate the value of parameters which contribute to products price. Identification of potential land based on data coastal and small islands zoning and Management of DKP Central Java Province. Then identify waters specification and land suitable for various types of commodities refers to the results of geographic information systems [6], [12].

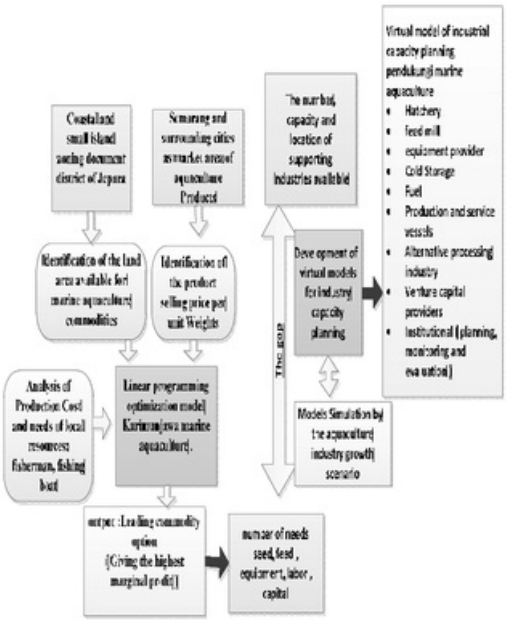

Figure 2. Karimunjawa Fishery Industrial Planning Frame Work

Purwaningsih [13] obtain optimal value for aquaculture commodity in Karimun islands by linear programming approach. Linear optimization model of marine aquaculture on linear programming approach done by developed a model of objective function to maximize profits. The constraints for the model are availability of funds, the limitations of cultivation land, limited water suitability of the characteristics of the commodity, and limited hatchery. Commodities cultivation under study consists of seaweed, grouper and scallops. Optimization results provide the commodity value of seaweeds produced by 3.36 million kg, 485,407.2 kg shellfish and grouper at 5790.60 kg. The maximum profit of Sea farming activities was Rp 2,163,846,000.00. The highest sensitivity level is shown on the grouper commodity. Therefore, special attention needed on production planning regarding changes in profits of grouper commodity to achieved optimum profit.

Tiskiantoro [6] analyzed the coast suitability for "Karamba" or cages used a geographic information system (GIS) applications. Result of GIS show that the Karimun Island and Kemujan Island has clean waters which can be used for sea farming. The research done by a survey method based on geographic information systems and determining the point of sampling using purposive sampling method. The measured data include dissolved oxygen, pH, salinity brightness, winds current speed, temperature, level of nitrate and phosphate. The results showed that the land which is in an appropriate category is 150.14 ha. The location are on Legon bay (Jatikerep) covering an area of 28.74 ha; Batulawang covering an area of 21.39 ha. Regions which include on appropriate classification conditional comprising an area of 69.54 ha 28.74 ha on Jatikerep; Batulawang 12.77 ha; Dukuh Telaga 5.82 ha and 21.23 ha at Jelamun. Fish cage can be operated in is 431 units of Karimun islands and 1,821 units on Kemujan islands.

Yang Sim et al [14] has developed a Practical Guide on Granting and Management Feed for grouper farmed. The Research result may be a reference to plan the amount of feed needs replacing livestock fish feed for aquaculture of grouper.

Ministry of Research and Technology of Republic Indonesia [15] published a fish farming of barramundi (*lates calcalifer*, *Bloch*) in a floating net cages. This Publication can be used for planning production facilities and to estimated cost of cage maintenance. This publication also provides an overview of sea farming maintenance management.

Ariyati et al [12] analyzed the suitability of waters and islands of Karimun islands and Kemujan as seaweed farming using geographic information systems. This Study conclude that som width area ari suitable for Sia farming.

4. VIRTUAL MODEL CONCEPT BUILDING

Industry capacity planning is an important factor on determine the cost of production, the product price and marginal profits. Important factors in planning capacity

are the accuracy of the results of market analysis, the size of a demand for the product. The development of aquaculture requires ease of obtaining access to raw materials and access to market. Raw material supply require large investments so that the potential development of aquaculture data should be available to attract investors.

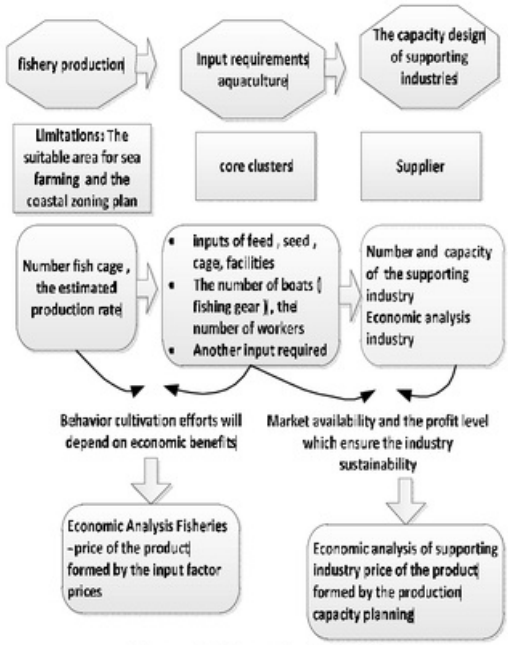

Figure 3. Conceptual Model

Figure 3 shows that the supporting industry capacity planning define by the number of users of products or farmer. Prices of input factors will affect to the cost of production of marine farming. If the input supply is difficult to get, or if the input material price is too high, then the profits will decline. On the other hand, the construction of a factory or industry also requires a certain amount or size of demand and future potential development to avoid over investment.

Pattern of Industries relationship is based on the behavior of the real object of the research. Data was obtained from historical data, interviews and the results of previous studies. The type of data required are given in Table 2.

Building a mathematical function requires knowledge of the relationship among the model parameters. For example, estimates of fish feed needs can be estimated by value of feed consumption ratio (FCR) of the species. FCR for groupers conditioned to consume dry pellet feed is 2:1. It means that need of pellets from 1.5 to 2 kg per 1 kg of fish weight gain. While using trash fish (live food) the grouper FCR is 1:6. Known the information of fish populations, time for farmed, body weight gain can be used to define the need of feed (dry pellets) for the fish. The formulation is below:

The amount of feed = (number of fish in the nets x average weight) x % of the daily food consumption.

For example in condition describe below:
Number of fish in Karamba : 1000
Average of body weight : 5 gr
Standard feed consumption: 4 % daily (according to the standard of NACA / Network of sea farming in Asia Pacific)

Food should be given every day is:
1000 x 5 x 4 % or 200 gr.

Table 2. Model Parameters and data source

No	Data of Models Parameter	Source of Data
1.	**Sea farming fish stocks and production**	
1.1	The annual production	Central Java MMF Report (2010 - 2013)
1.2	Width of appropriate area	Tiskiantoro (2006), Ariyati et all (2007)
1.3 1.4	The production function / growth rate FCR (Food Consumption Ratio)	Kemristek, (2001), Harvesting is done after weighing up to 500 g / tail FCR fish kerapu 1 : 2 (Sim, S.Y.,Rimmer, 2005)
1.5	The number of cage and its growth	MMF Report (2010-2013)
1.6	Production rate/ cage	2.250 kg/unit/period
1.7	Survival rate	90 % (Kemristek, 2001),
2.	**Economic analysis of Sea farming**	
2.1.	Estimation Number of boats and fish farmers	interview
2.2.	estimated cost of investment	interview
2.3.	The number and needs of feed pellets	interview
2.3.	The number and needs of seedlings	Seed density function of hatchery fish size 50-70 g / fish reared in cage , stocking density of 50 -70 fish / m3 water volume
3.	***Supporting Industries***	
3.1.	Annual production per type of industry	Report of Disperindag
3.2.	input material needed according to fish populations	interview
3.3.	A list of the industry and its capacity available	Data Industry Ministry of Environment and Disperindag
3.4.	Growth in the number and capacity of the industry	Scenario
4.	**Economic analysis of supporting industries**	
4.1.	The production process and production equipment	Field Study and interview
4.2.	Estimation of investment and operational costs	Field Study and interview
4.3.	Types of industrial	interview

	workers and large wage labor costs	
4.4.	The selling price of products/equipment	Product catalogue and interview

Similarly, for other input factors such as seeds, cage, boats, manpower requirements and other parameters calculated by identifying the relationship between these parameters with the population or stock of fish from the library or from interviews result.

When the virtual model have finished, then some validation and Verification Test should be done. Sterman [16] states that the main assumption decision-making structure as a set of causal structures are circular and closed. Cause and effect elements are mapped and measured on both qualitatively and quantitatively. The model must be able to demonstrate measurable parameters of various policy scenarios were made so that the model can be expressed quite trustworthy.

Verification of the model is a correspondence between the conceptual models and a mathematical model. The validation phase is useful to see how far the model follow the patterns of the existing reference. A model must be in accordance with the empirical reality. Validation is required to determine whether the model and output are not deviate from the existing reference system. Given the high uncertainty in aquaculture production, the data on the number of fish production are estimated using a mathematical formula.

5. CONCLUSION

Based on the literature study and field study can be drawn some conclusions. First, suitability assessment of karimunjawa coast waters specification for sea farming showed that some locations such as Jatikerep, Batulawang and Dukuh Telaga are fit to be used as farming sea land. This result are conclude from Geographic information System Research.

Second, The sea farming development framework consist of phase three phase (1) mapping of potential, (2) the development of supporting industries, (3) implementation. The second phase has not been implemented in Karimunjawa and recently karimunjawa marine fisheries have not had adequate supporting industries and market access.

Third, Planning of supporting industrial capacity requires a virtual model to estimate the amount of demand for various material inputs such as seeds, production equipment, fish feed, medicine and others infrastructure .

Fourth, this virtual model can be constructed by studying the relationship between the amount of input quantities of fish Farm requirements with the number of potential development based on units of fish populations, the breadth area and the number of Karamba or Cage that can be cultivated.

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