Analysis of Internal Risk Management in Indonesian Seaweed Farming

Harifuddin Thahir, Elimawaty Rombe, Ponisri, Gatha Vesakha, Suryadi Hadi*

Department of Management, Faculty of Economics, University of Tadulako
Jl. Soekarno - Hatta km 9, Tondo - Palu 94118, Central Sulawesi Province, Indonesia

Abstract

This study aims to identify the internal risk management and acknowledge the highest and the lowest risk that have significant impact on seaweed farming in Indonesia. The case study is used in Morowali-the central seaweed farming in Indonesia. The data obtained from primary data and secondary data and used a census through interview and questionnaire. Data analysis apply analytic hierarchy process (AHP) to determine the weight of each criterion and sub criteria. The results show that the internal risks of seaweed operation by Indonesian farmers include the quality of seeds, technology, human resources, capital and cost management. The study found that the highest internal risk of seaweed operation on the farmers level is technology. This study provides insight and information to the seaweed farmers and manager of seaweed industry about the typical of internal risks in the farmers level.

Keywords: *risk, management, seaweed, and AHP*

1. Introduction

Indonesia is the largest seaweed producer in the world, especially for the type of Eucheuma Cottoni. FAO (2015) claim that Indonesia was nominated as the top seaweed producer in the world. Indonesia successfully produced *E.cottoni* 8.3 million tons and increased by 10.2 million tons in 2014 (KKP, 2015). Based on data from the Indonesian Ministry of Trade, the total seaweed export in 2013 reached 162.45 million USD dollars and accounted for 226.23 million USD in 2014.

In general, Indonesian seaweed farming is operated in the traditional method. In other words, the farming system has lack of technology. According to Sujiharno, there are several critical factors that need to be considered in seaweed farming include: (1) the selection of locations that meet the requirements for the type of seaweed that will be cultivated. This is necessary because there are different treatments for each type of seaweed. (2) selection or selection of seedlings, provision of seedlings, and proper breeding methods, (3) appropriate cultivation methods, (4) maintenance during the planting season, and (5) correct harvesting and postharvest treatment methods.

This study aims to identify which aspect of internal risks in the seaweed farming. The following parts of this paper consist of theoretical basis, research method, results and discussion and conclusion.

2. Literatur Review

2.1 Risk Management

The concept of risk several definitions of risk as can be seen below[2].
a. Risk is the chance of loss

Chance of loss is usually used to indicate a situation where there is an exposure to a loss or a possible loss. Conversely, if it is adjusted to the terms used in statistics, then "chance" is often used to indicate the level of probability that certain situations will arise. Authors to whom correspondence should be addressed.
b. Risk is the possibility of loss
The probability of an event being between zero and one. This definition may be very close to the understanding of risk used in quantitative analysis.
c. Risk is Uncertainty
There seems to be an agreement that the risk is related to uncertainty, namely the existence of risk, due to uncertainty. Risk management is a field of science that discusses how an organization applies measures in mapping various existing problems by placing various management approaches in a comprehensive and systematic manner[1].

2.2. Quality of Seeds

The quality control is an attempt to maintain the quality of the goods produced, in accordance with product specifications that have been determined based on the policies of the company leader[3].
Based on the above understanding, it can be concluded that in the selection of seaweed seeds that will be cultivated need quality control so that the cultivated seaweed produces quality products.

2.3 Technology

Technology is a process that increases added value, the process uses or produces a product, the product produced is not separate from other existing products, and the arena becomes an integral part of a system[4].

2.4 Human Resources

The quality of human resources in the maritime field was carried out through education, training, comparative studies, field practice and research[5].

2.5 Capital

Capital is one of the important factors in addition to other factors, so that a business cannot run if there is no capital available[6].

2.6. Management Fee

The calculation of production costs is: "One of the activities carried out by the company accurately, precisely and clearly is also very important in determining the cost of goods sold for achieve the expected profit target"[7].

2.7. Analytical Hierarchy Process (AHP)

The method of analytical hierarchy process was introduced to identify which criteria and sub criteria have highest and lowest score. Basically, steps in AHP includes[8]
1. Define the problem and determine the desired solution, then compile the hierarchy of problems encountered.
2. Determining the priority of the elements: a) make a comparison of pairs, that is comparing elements in pairs according to the criteria given. b) A paired comparison matrix is filled with numbers to represent the relative importance of an element to the other elements. The following table paired comparison scale[9].

Table 2.1 AHP Pairing Scale

No	AHP scale in pairs
1	Both factors are equally important to the goal
3	One factor is slightly more important than the other
5	One factor is more important than the other
7	One factor is more important than the other
9	One absolute factor is more important than the other
2,4,6 and 8	Middle values between two adjacent decision values .When a compromise is needed.

3. Synthesis considerations for paired comparisons are synthesized to obtain overall priority. The things done in this step are: a) Summing the values of each column in the matrix. b) Divide each value of the column with the corresponding total column to obtain the normalization of the matrix. c) Sums the values of each row and divides them by the number of elements to get the average value.
4. Measuring consistency of decision-making, it is important to know how well the consistency that exists because we do not want decisions based on consideration with a low consistency. The things that are done in this step are: a) Multiply each value in the first column with the relative priority on the first element, the value in the second column with the relative priority of the second element, and so on. b) Add each row c) The result of the sum of rows divided by the relevant relative priority element . d) Sum it up with the number of elements present, the result is called λ max .
5. Calculate the Consistency Index (CI) with the formula: CI = (λ max-n) / n-1 where n = the number of elements.
6. Calculate Consistency Ratio (CR) with formula: CR = CI / IR Where: CR = Consistency Ratio CI = Consistency Index IR = Index Random Consistency .
7. Check the consistency of the hierarchy. If the value is more than 10%, then the judgment data assessment should be corrected. However, if the consistency ratio (CR) is less than or equal to 0.1 (CR < = 0.1), then the calculation results can be declared true or consistent. List of Index Random Consistency (IR) can be seen in the following table:

Table 2.2 Consistency Index

Matrix Value	IR size	Matrix Value	IR size
1,2	0.00	9	1.45
3	0.58	10	1.49
4	0.90	11	1.51
5	1.12	12	1.48
6	1.24	13	1.56
7	1.32	14	1.57
8	1.41	15	1.59

3. Research Method

The type of this research is descriptive research. Descriptive research tells and interprets data relating to facts, circumstances, variables and phenomena that occur in the management of seaweed commodities in Bumi Raya District in Morowali Regency. The research location was considered because the district has several seaweed farmer groups of Eucheuma Cottoni. In addition, Bumi Raya District has been chosen as a pilot project for developing of minapolitan area in Morowali Regency.

The type of data used in this study is quantitative that is measured data in the form of numbers, which relate to research. Qualitative data are types of data in the form of sentences or statements related to research. The data obtained directly from observations and interviews in the field of study. This study also obtained literature review that relevant to this research. A total of 66 respondents were divided into: 27 people from Pebotoa village, 26 people from Bahonsuei village and 23 people from Parlangke village.

4. Results and Discussion

4.1. Case Study

Central Sulawesi Province since 2007 has declared that "Central Sulawesi becomes the Province of Seaweed in 2011", through the Gema Biru program (Mass Movement of Seaweed Cultivation). Central Sulawesi is the province that is the second largest contributor to seaweed in Sulawesi Island after South Sulawesi . Central Sulawesi targets an increase in seaweed production of around 30% per year. So that in 2014 total production reached almost 2 million tons. There are several clusters of seaweed development in Central Sulawesi Province, namely Makassar Strait and Sulawesi Sea, Tomini Bay and Tolo Bay.

Morowali Regency, which covers most of Tolo Bay, is now one of the samples development of minapolitan areas. (Data of Department of Marine and Fishery / DKP Morowali 2016) stated that Regency of Morowali in 2015 is location with wide suitability of seaweed cultivation area *Eucheuma cottonii* covering 143,396,83 Ha which consist of category very appropriate with wide 5,373,11 Ha, with an area of 138,023.72Ha and the total production of dried seaweed as much as 420,123.50 tons.

Spacious area with the suitability of land with the largest cultivation is South Bungku District with an area 59500.97 hectares and total production of dried seaweed as much as 128,635.00 tons, followed by Menui Islands District with an area of 50511.09 hectares and total production of dried seaweed was 90965.50 tons. Bumi Raya District with an area of 13037.68 hectares and total production of dried seaweed as much as 69176.00 tons and Wita Ponda District with an area 5246.16

hectares and total production of dried seaweed as much as 45632.00 tons.

Bumi Raya is one of the widest district which ranks third for the management of seaweed cultivation in the Regency Morowali. Management of seaweed cultivation in the region of the Bumi Raya District optimally geared to improve the welfare of local communities while maintaining the sustainability aspects of seaweed farming in a sustainable, effective, efficient and optimal.

4.2 Risk Management in Seaweed Farming

The results of risk analysis of seaweed management show that there are five (5) internal risks of cultivation management, namely the quality of seeds, technology, human resources, capital and management costs.

a). Seed quality

Provision of quality seeds is one of the activities that greatly determines the success of seaweed cultivation. These activities include selection, storage, and cutting of the *thallus*. Provision of seeds that are not continuous, especially on the growth of seaweed is not good is one of the risks that will cause the yield is not maximal. Provision of seeds should be selected. The following characteristics of the high quality of seeds from the harvest include:

a. Branched a lot, thick and pointed
b. There are no spots and peeling
c. Bright specific color
d. Age 25-35 days and the weight of the seeds planted is between 50-100 grams per clump and not affected by ice-ice.

Several factors need to consider in delivering the seeds to avoid damage during the trip include:

a. Seed should be kept wet / humid during the trip
b. Not exposed to fresh water / rain
c. Not exposed to oil or other impurities
d. Away from heat sources such as vehicle engines and others
e. Not exposed to sunlight.

b). Technology

The management process in the seaweed cultivation starts from the selection of seeds, binding to the rope, maintenance, planting, harvesting, and drying. is relatively still managed with simple equipment. The community of seaweed farmers in Bumi Raya District has now used a plastic (nylon) strap. The nylon rope used is the number 35 for the frame rope, number 12 for the embankment rope, number 10 for the anchor rope and number 6 for the rope stretch as a hanging medium. Nylon rope technology is more resistant to waves and can last up to 5 years. Seaweed that has been cultivated at the site, every time supervised, especially observes the possibility of irregular ropes due to the influence of the waves using a boat.

Other equipment is used by the farmers consist of a black ball for a rectangular float and a 500 ml / 600ml plastic bottles for a float in the farming area. For example, a farming area will need of 3 boots of plastics bottles with a stretch length of 15 cm. In addition to markers, a knife and ice skin are needed to tie the seeds to a stretch rope. When drying, seaweed farming in Bumi Raya District only use the platform around the coast of the sea or the side of the road using bamboos rack. Such media of drying are less optimal which result in a level of drought. As a result, collectors will reduce the quality standards and impact on the price level.

c). Human Resources

Human Resources are required to prevent unsatisfactory results. They labors are needed for seaweed farming to seed selection, to tie seeds and the rope, to cultivate, to maintenance, to harvest, to dispose, to stretch, to drainage and to clear of strand ropes.

d). Capital

Seaweed production that does not recognize seasons (continuous production) requires the availability of large capital that can provide high profits. For the purposes of capital or financing of seaweed cultivation in Bumi Raya District, there was information that the banks are ready to finance businesses seaweed cultivation

in accordance with existing credit schemes and meet the banking feasibility. The financing of farmers' businesses for seaweed cultivation in Bumi Raya District come from their own capital, which is 75%, loans or loans of 25%. The business capital obtained by farmers is used to purchase cultivation infrastructure materials such as seaweed seeds, nylon rope (no. 35, no. 12, no. 10 and 6), black balls, aqua bottles of 500 ml / 600 ml size, ice skin and operational costs.

e). Cost Management

Cost management of seaweed cultivation in Bumi Raya District require substantial funds, particularly for new farmers who began the cultivation of seaweed, because of the costs that is used in the production process such as labor costs very much. The costs incurred for the management of seaweed cultivation are the cost of selecting seeds, tying the seeds to the rope stretch, cultivating seaweed, maintenance, harvesting, seaweed release from the rope stretching, drying and stretching the rope. Therefore, seaweed farmers must be able to minimize the costs used to avoid losses.

4.3 Analytical Hierarchy Process

After each criterion and sub criteria is obtained then synthesis is done to get the overall priority weight of the criteria. Previously local priority must find out the global priority. This global priority can be obtained by multiplying local priority with priority level. This global priority is carried out after the opinion matrix meets the requirements of the inconsistency ratio. In detail, the results of weighting criteria and sub criteria can be seen in the following table:

Table 4.1 Global Priority

Aim	Criteria	Weight	Sub Criteria	Weight	Priority
Management Risk	Seed Quality	0.135	Lush	0.016	IV
			Pointed	0.018	
			Not peeling off	0.049	
			Bright colors	0.014	
			Age 15-20 days	0.038	
	Technology	0.341	Boat	0.045	I.
			Nylon rope	0.084	
			Ice skin	0.076	
			Black ball	0.041	
			Plastic bottle	0,034	
			Knife	0.031	
			Stakes	0.031	
	HR	0.264	Seed selection	0.051	II
			Tie the seeds to a stretch rope	0.028	
			Cultivate seaweed	0.045	
			Maintenance	0.020	
			Harvesting	0.033	
			Release of seaweed from a stretch rope	0.034	
			Drying	0.041	
			Stretch rope	0.012	
	Capital	0.114	Eucheuma cottoni seeds	0.026	V
			Nylon rope	0.020	
			Plastic bottle	0.023	
			Black ball	0.019	
			Ice skin (seedling straps)	0.026	
	Cost management	0.147	Seed selection costs	0.031	III
			The cost of seedling	0.016	
			Cultivation costs	0.025	
			Maintenance cost	0.011	
			Harvest costs	0.021	
			The cost of releasing seaweed from a stretch rope	0.017	
			Drying costs	0.029	
			The cost of clearing the straps	0.007	

Based on Table 4.1 shows that in choosing the risk of seaweed management, the first priority is the technology criterion with weight 0.341. Technology is a process that increases added value, the process uses or produces a product, the product produced is not separate from other existing products, and the arena becomes an integral part of a system[4].

Based on the result, technology is one of supporting factor in the cultivation process that can increase maximum production[4]. This

technology cannot be underestimated, because technology can reduce production costs and risks that have significant impact on product loss. Inappropriate technology in the cultivation process will effect on the unexpected costs. The high risky technology is nylon rope. If there is no attention to defects in nylon ropes or damage during cultivation, nylon rope can be cut off due to wave shock. As a result, seaweed cultivation will be released and drifted.

The risk of human resources is initiated as the second priority in managing seaweed cultivation. Human resources is also not less important with technology, which has a weight of 0.264. Human resources has significant role to decrease seaweed production and the process of cultivation. The ability of human resources in the cultivation process is workers who do not have the same expertise. There are workers who already have the ability and expertise above average and there are also workers who are not too proficient so it takes time to learn and adapt. Human resources that are most at risk are workers in the seed selection section. This part is most vulnerable to determine seaweed production. If the quality of seeds is not considered, the production will be minimal.

The third priority is the cost management criteria with a weight of 0.147. Management costs can be a risk opportunity for the management of seaweed cultivation when the workforce is not on time. The cultivation process will have negative impact on the seaweed farming because of high costs. In addition, when a lot of broken ropes and loose marks from seaweed farmers are forced to pay extra for seaweed cultivation.

The fourth priority is the criteria quality of seeds with a weight of 0.135. Selection of seeds that do not fit with the criteria are vulnerable to the crops. Most of seaweed farmers consider it during the seed selection so that the income will increase. The risks that are most susceptible to seedlings are peeled off. Seeds that are peeled off due to scratches can cause the production to decrease. The reason for this, the seeds that are cultivated in the exfoliated condition will rot apart. The last priority is the criteria of capital which has weight of 0.114. Capital in seaweed cultivation is enough to drain the bag of farmers. This capital can hamper the cultivation management process if one has not been fulfilled. The most widely used capital is capital for nylon rope.

5. Conclusion

Based on the results of the analysis described, it can be concluded that there are five internal risks in the management of seaweed in the District of Bumi Raya, Morowali Regency, namely the risk of seed quality, technology, human resources, capital and cost management. This study found that the highest internal risk of seaweed farming is the technology with 34%. Then, the following risks include human resources (26.4%), cost management (14.7%), seeds quality (13.5%), capital (11.4%) consecutively. These level of risks should be properly managed so that the negative impact on the the profit of seaweed farming will be less. The future research should be conducted in different method to analyze the relationship between internal and external risks in seaweed farming performance.

Reference

[1] Fahmi, Risk Management Theory, Cases and Solutions. Third print, Alphabet. Bandung. (2014).
[2] Herman. Risk Management. Earth Literacy. Jakarta. (2004).
[3] V. Gasperz. Total Quality Management. Jakarta: PT.Gramedia Pustaka Utama. (2005).
[4] Y. Miarso. Matching the Educational Technology Seed. Kencana Publisher & UNJ: Jakarta (2007).
[5] D. Setiawan, Human Resource Competency in Efforts to Utilize Marine Potential in Tasik Malaya Regency . Regional and City Planning Journal. Vol. 21.No.1 69-80. (2010).
[6] Z. Afifah. Analysis of Capital Assistance And Credit For Micro Business. Diponegoro University. (2012).
[7] H. Mowen. Management Accounting for Cost Calculations. 7th Edition, Salemba Empat. Jakarta. (2006).
[8] Kusrini. Concept and Application of Decision Support Systems. Yogyakarta. (2007).
[9] C. S. Simamora. Product Promotion Strategy Analysis Mahkota Dewa di PT Mahkotadewa Indonesia Jakarta. Bogor Agricultural University. (2005).