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FINANCIAL RISK ASSESSMENT OF POST-TSUNAMI 2004 SHRIMP PRODUCTION IN ACEH

Penilaian Risiko Finansial pada Budidaya Udang Pasca Tsunami 2004 di Aceh

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Abstract

This study aims to identify and to measure the impact of financial risks on shrimp farming in relation to post-tsunami 2004 in Aceh and shrimp diseases. Interviews using questionnaires were conducted on 47 shrimp farmers in five shrimp producing regions in Aceh Province. The risks assessments were measured in frequency of the occurence and the severity of the impacts. This study shows that financial risks due to natural disasters and diseases consisted of production and marketsaspects. The deterioration in selling prices and the increase in production costs would affect major impacts as well as having relatively high frequencies.

***Keywords*:** *Aceh shrimp production, financial risk, diseases, post tsunami 2004*

Abstrak

Penelitian ini bertujuan untuk mengukur dampak risiko finansial pada budidaya udang di Aceh kaitannya dengan perubahan lingkungan pasca tsunami 2004. Sebanyak 47 petambak di 5 kabupaten penghasil udang di Aceh diwawancarai menggunakan kuisioner. Pengukuran risiko dilakukan dengan cara melihat frekuensi kejadian dan tingkat keparahan dampak. Hasil peneitian ini menunjukkan bahwa pasca tsunami 2004 dan maraknya penyakit udang, risiko finansial bersumber pada dua ancaman utama yaitu risiko produksi dan risiko pasar. Gangguan pada harga jual udang saat panen ditambah dengan kenaikan biaya produksi memiliki kejadian dengan frekuensi tinggi dan dampak yang parah.

Kata Kunci: Budidaya udang Aceh, risiko finansial, penyakit, pasca tsunami 2004

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INTRODUCTION

Shrimp is one of the most important fishery-based commodities in Indonesia. Registered under HS Code 160521 (crustaceans, molluscs and other aquatic invertebrates, prepared or preserved), the total export of this product from Indonesia to the world market accounted for USD $276,340,628 or equals to 29,777,067 kg in 2018 (Comtrade, 2019). Several main markets are Japan, the United States, and the European countries. On the one hand, Indonesian shrimp agro-industry businesses are facing problems in product quality, quantity and continuity which may reduce its competitiveness in the global markets (Nasution, Arkeman, Soewardi, & Djatna, 2014). On the other hand, industrial expansion related to shrimp farmings have also been a significant factor in environmental, land use and global trade changes. One of the negative consequences is the emergence and spread of aquaculture diseases (Walker & Mohan, 2009). This makes shrimp as one of the riskiest business in terms of cultivation, economic, financial, environmental as well as social aspects.

Risk is defined as uncertain consequences and usually in the form of unfavorable results, due to imperfect knowledge (Hardaker, Richardson, Lien, & Sch, 2004). Risk can be managed by reducing or eliminating hazards, i.e. sources of risks. On the other hand, danger is a threat that can contribute to risk but does not always result in risk. In aquaculture, the dangers can be broadly classified as production or economic or market threats (Harwood, Heifner, Coble, Perry, & Somwaru, 1999). Specifically, financial risk is the possibility of financial loss in the future caused by threats to the production process and the market (for example price and demand). Production threats include, for example, environmental problems, equipment or other asset failures, poor quality seed stocks and disease attacks. The negative impacts on production will reduce the quantity and quality of yields which ultimately results in financial losses (Harwood, Heifner, Coble, Perry, & Somwaru, 1999). Market threats can take the form of price changes and product regulations. Cultivation competition or reduced demand can cause a decline in shrimp prices. Both aquaculture competition and reduced selling prices will reduce the income associated with shrimp sales. In addition, the increase in the price of production inputs also poses a market threat because it reduces the profit of shrimp farmers. Likewise, shrimp farmers are also exposed to high risks if the supply of inputs, especially feed is limited

Historically, Aceh is one of the important shrimp producing regions in Indonesia especially for *Giant Tiger* (*Penaeus monodon*). Production and market risks affect fluctuations in shrimp production in Aceh as well as shrimp farmer's economy. Regarding production risk, natural disasters and diseases are two factors that have caused negative direction in the development of Aceh shrimp production post tsunami 2004. In the early 2000s, virus outbreaks have droped *giant tiger* production amounts in various parts of Aceh. The loss due to this disease can be from more than 50 percent to total failure. Many efforts have been applied from traditional (e.g. water treatment, early harvest, etc) to scientific approach using manufactured chemicals, but still no positive effects on the yield.

In 2004, the earthquake and tsunami caused huge number of casualties of coastal population, damage to aquaculture property (see Table 1) , and loss of community livelihoods, as well as damage to coastal ecosystems and reduced pond areas in Aceh (Zainun, Suseno, Yanis, & Mifftachhuddi, 2007). The area of ponds after the tsunami disaster that caused damage to ponds in Aceh was 20,429 hectares, with details of 5,859 hectares being slightly damaged, 5,127 hectares being moderately damaged, 7,270 hectares being heavily damaged and 1,022 hectares being destroyed (FAO, 2008). Although several coastal livelihood recovery has been implemented after the disaster, the long run effects on farmers' economy

are still pronounced till recently. For example, loss in the farmer's family members has made the next generation difficult to cultivate the ponds, shrimp production knowledge was not succesfully transferred among generation, and labor resources have become rare. Many of them have changed their jobs into other areas than fisheries such as traders, craftmen, construction laborers.

The latest development of both giant tiger and white legs shrimp farming in Aceh that has been described previously is associated with variety of risks that will ultimately affect shrimp farmers financially and economically. This study intends to identify the financial risks of shrimp farming in Aceh Province during the post-tsunami 2004 to 2018 periods. Financial risks become the focus of this study due to its important parts of farmers' decision to sustain their willingness in the shrimp production system in Aceh. The identification of financial risks interms of their sources, probabilities as well as their impacts on farmers' economy is expected to explain the current challenges faced by the farmers as well as future shrimp development in Aceh.

Table 1. Estimated Damaged Ponds in Aceh Province after the Tsunami 2004

No.	City/ Regency	Sub-district	Size (Ha)	Estimated Damage	
				Ha	%
1.	Banda Aceh	Syiah Kuala	130	130,00	100%
		Kuta Alam	150	150,00	100%
2.	Aceh Besar	Mesjid Raya	192	192,00	100%
		Peukan Bada	50	50,00	100%
3.	Pidie	Kembang Tanjong	216	194,40	90%
		Bandar Baro	207	144,90	70%
4.	Bireuen	Samalanga	43	30,10	70%
		Jeunieb	85	51,00	60%
5.	Aceh Utara	Seunedon	260	130,00	50%
6.	Lhokseumawe	Blang Mangat	100	45,00	45%

Sumber:Potensi Desa Provinsi Aceh, BPS Aceh.

Up to the year of 2010, *Litopenaeus vannamei* (white legs shrimp) which was more resistant to disease were introduced into Aceh. The year 2010 to 2018 probably the most significant change in the development of Aceh shrimp production. This period was characterized by signifcant growth in the *Litopenaeus vannamei* and its production exceeded *giant tiger's* yield, rapid changing in the cultivation methods, pond use, and marketing systems. In contrast to *giant tiger*, the *Litopenaeus vannamei* is heavily depended on feedings and complementaries. The structure of the supply chains are more connected from the juvenniles suppliers to the exporters. The new system is also an opportunity for feedings companies to expand their networks. Finally, the small holder's barriers to entry are becoming more stringent due to lack of capital.

METHOD

This study was carried out in 5 regencies in Aceh Province, namely Pidie, Pidie Jaya, Bireun, Langsa and Aceh Utara. These regions were purposively selected due to their pond sizes and portion of shrimp production amount in the province. Totally, 47 shrimp producers were selected as the main samples using accidental sampling method and they were interviewed using a set of questionaires. Data

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collection was carried out from February to April 2019.

In the hazard identification stage, various sources of information and keypersons have been consulted to identify hazards sources contributing to financial risk. In collecting primary data, surveys of farmers and general consumers are carried out by reviewing sophisticated practices and gathering information about threats and hazards from relevant respondents (Meira, Quagrain, & Engle, 2003). Stakeholders whose investments are at risk can provide significant insight when identifying hazards. These stakeholders are the complementary samples including government agencies, consumers and affected industries. In this research, seven sources of financial risks were selected including: decreased shrimp prices, increased production costs, scarcity of the inputs (feedings), increased interest rates, decreased market demand, limited marketing access, instability of lenders/creditors in providing loan or capital.

Risk assessment can be conducted using either qualitative, quantitative, or combination of both approaches. Qualitative risk assessment can be carried out with a reasonable and logical discussion of relevant factors stated in non-numerical terms or in categories such as high, medium, low or can be ignored. An example of a qualitative approach is Import Risk Analysis (IRA) which can be found in (Murray, 2002). Similarly, quantitative methods are useful for investigating financial risk in aquaculture because financial risk generally implies monetary losses as indicated by financial ratios in financial statements. However, the complexity of the cost structure and revenue from shrimp farming, coupled with the scarcity of financial data that is neatly arranged in a report, especially in traditional aquaculture, a simple qualitative approach is the most appropriate to the situation. In this study, the risks will look at two aspects, namely the level of impact (severity) and the probability of risk occurrence (frequency) as suggested by (Engemann & Henderson, 2014).

RESULT AND DISCUSSION

Respondents' Socio-demographic Characteristics

This study was conducted in 5 regencies in Aceh province, namely Pidie, Pidie Jaya, Bireuen, Aceh Utara and Langsa which are located on the east coast of Sumatra Island, and are the main shrimp producing areas in this region. In this study there were 47 samples consisted of 9 respondents reside in Pidie, then 14 respondents in Pidie Jaya, 11 respondents in Bireun, 9 respondents in Aceh Utara and 4 respondents live in Langsa City. Based on the sex of the respondents, as many as 45 respondents or equal to 95.7 percent were male and 2 respondents were female. The average age of respondents is between 16 to 65 years or equals to 97.9 percent were in the productive phase, and the remaining samples are over 65 years or equal to 2.1 percent. The dominancy of male workers distinguished the characteristic between aquaculture and paddy production in these regions. Shrimp farmers and fishermen are normally males while female workers were also involved ocassionally during harvest.

In terms of educational level, approximately 6.4 percent of the respondents were not attending school, around 21.3 percent attended elementary school, 17 percent graduated from junior high school education, 36.2 percent graduated from high school, and 19.2 percent obtained degree from universities. The respondents' experience in shrimp cultivation desribe their capacity and knowledge to adapt manage the risks. The result found that around 57.5 percent of the respondents started to manage ponds below than ten years while approximately 42.6 percent of the remaining experienced the disturbance on their shrimp productions during and after the tsunami 2004.

Table 2. Respondent Characteristics

Variable		Frequency	Percentage (%)
Sex	Male	45	95,70
	Female	2	4,30
Age (years)	< 15	0	0,00
	16≤ age ≤ 65	46	97,90
	> 65	1	2,10
Education	Not attending school	3	6,40
	Primary HS	10	21,30
	Junior HS	8	17,00
	Senior HS	17	36,20
	Higher Education	9	19,20
Sources of income	Government agency	3	6,40
	Farmers	13	27,70
	Laborers	1	2,10
	Private employees	1	2,10
	Enterpreneurs	29	61,70
Shrimp production experiences (years)	< 5	20	42,60
	5 ≤ years ≤ 10	7	14,90
	> 10 years	20	42,60

Source: Data processed (2019)

The study found that as many as 27.7 percent of the respondents' income source come from aquaculture ponds only, while the remaining 72.3 percent of the respondents stated that they also worked as civil servants, laborers, private employees and traders. It is indicated that the farmers' dependance on shrimp production have been decreasing overtime. Afer the tsunami 2004, laborers were absorbed in the reconstruction of phyical infrastructures and housings during the recovery process and received additional incomes. Some of the farmers returned to re-cultivate the shrimps during the implementation ponds rehabilitation programs between the year of 2005-2008. However, many of them have ended in failures due to many factors including diseases. From that experience, farmers' economic rationale have shifted the income from single source to multiple sources. An overview of the characteristics of respondents can be seen in table 2.

Shrimp Production Characteristics in Aceh

The majority of shrimp ponds are located in coastal areas, both western and eastern sides of the Aceh province. The water mainly comes from the sea while limited underground water is utilized in some areas to treat the salinity level. Based on the observations and interviews, respondents stated that the quality of coastal water is still within the limits of eligibility. Based on land ownership, around 76.60 percent of the total respondents have registered their lands for shrimp production or other aquaculture.

Most of the farmers carry out 3 types of cultivations, namely intensive, semi-intensive and traditional. Additional technology and equipments such as water pumping machines, aerators, mats and others as well as massive feeding stocks are seen in the intensive ponds. Additionally, routines such as an active water quality measurement and management performed using several measuring devices e.g. pH, temperature indicator. A semi-intensive pond uses more simple technology and employs a cmbination of natural and manufactured feedings. In contrast to the previous types, an extensive pond is very depended on nature and the application of the equiments is very rare. According to the type of cultivation, as many as 65.96 percent of the respondents were extensive, 12.77 percent were semi-intensive and 21.28 percent were intensive.

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Table 3. Characteristics of Shrimp Farming in Aceh

Variable	Regency	Average	Unit
Pond size	Pidie	2.79	Ha
	Pidie Jaya	0.45	Ha
	Bireun	1.89	Ha
	Aceh Utara	3.12	Ha
	Langsa	3.10	Ha
Number of harvest annually		3.00	Times
Yield per harvest		1,65	Kg/Ha
Income per harvest		66,11	IDR
Variable		Frequency	Percent (%)
Types of shrimp	Vannamei	28	59.57
	Giant Tiger	14	29.79
	Mixed	5	10.64
Type of cultivation	Extensive	31	65.96
	Semi-intensive	6	12.77
	Intensive	10	21.28
Land registered	Bersertifikat	36	76,60
	Tidak Bersertifikat	11	23,40

Source: Data processed (2019)

The average size of the ponds in the five regions is around 1.97 hectares. The largest size on average was found in Aceh Utara and Langsa (around 3 hectares) whereas the smallest pond size was in Pidie Jaya (0.45 hectares). The shrimps were harvested 3 times in a year with income per harvest was around IDR. 66,106,383. The productivity was approximately 1,654.89 kg/ha which was much lower than several decades ago. The selling price at the farmers gate was around IDR. 50,000 to 60,000/kg for the vannamei and IDR 90,000 to 130,000/kg for the *giant tiger*. It seemed that the shrimp prices have not changed significantly over the last ten years.

The result also found that some shrimp farmers are not willing to change their shrimps giant tiger into *vannamei*. Approximately 29.79 percent of total respondents keep cultivating giant tiger since the beginning. As many as 59.57 percent or equals to 28 respondents have changed their shrimp into vannamei and 5 respondents or equals to 10.64 percent of farmers might have been cultivating both giant tiger and vannamei (mixed). An illustration of the characteristics of shrimp production in Aceh can be seen in table 3

Financial Risks Characteristics of Shrimp Farming

There were seven threats related to financial risks in the shrimp production that were identified in this study, including the decline in shrimp selling price

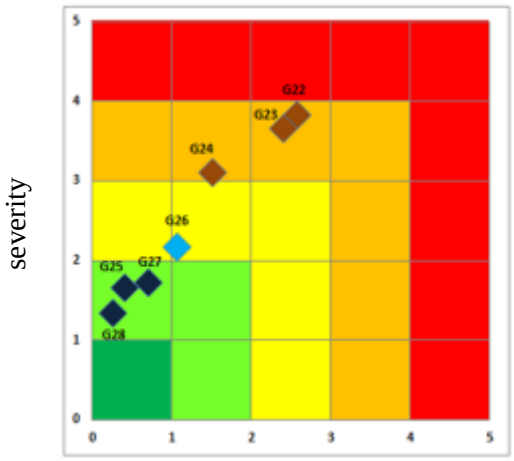

Figure 1. Financial Risk Assessment of Shrimp Farming in Aceh Province (2019)

(G22), increased production costs (G23), scarcity or

limited input (G24), increased loan interest rates (G25), decreased demand market (G26), limited marketing access (G27), and instability of lenders / creditors (G28) in providing loan for working capital. Each source of threat is then confirmed to shrimp farmers in terms of the severity of the impact as well as the frequency of occurrence. The severity of the impact was given a category of 1 = insignificant, 2 = minor, 3 = moderate, 4 = major, 5 = catastrophic. As for the level of probability of occurrence, categories were given in the form a = never, b = almost never, c = seldom, d = often and e = always. This risk assessment was done in one production cycle basis. The results of evaluating the financial risk of shrimp farming are shown in Figure 1 below.

Based on Figure 1, it can be stated that shrimp farmers perceive a decrease in selling price (G22) as the most negative threat to the shrimp farmers financially, as well as having the most frequent occurrence in almost every shrimp production cycle. In the next position, rising input prices (G23), especially the cost of feed and labor is a very serious threat and drains the benefits expected by shrimp farmers. Regarding input limitations, the impact is greater than the probability of occurrence. This shows that, although it is rare, input limitations can be a significant threat to shrimp farmers. The decline in market demand is the only threat that almost never occurs in terms of frequency of occurrence. This indicates that shrimp is a commodity that has a stable market share even almost always lacking supply. There is a relationship that must be further investigated between high demand and the instability of shrimp prices.

Marketing access, changes in loan interest rates and instability of creditors or providers of capital are almost certainly never the case with shrimp farming in Aceh. Regarding financial support, both formal and informal, is not an important matter in terms of financial risk for shrimp farmers in Aceh. Likewise in market access, the shrimp marketing chain in Aceh has been formed in such a way as to be able to reduce the possibility of losses to farmers. However, several studies also indicate that the farmer is also influenced by the length or shortness of the marketing chain.

CONCLUSION

Shrimp farming business characterized by high demand of inputs, profitable income while at the same time, it has high risk of failure (high input-high profit-high risk). Financial risk is one of the common risks feared by shrimp farmers because it is directly related to the eonomic sustainability of shrimp farms. Appropriate risk management is required to reduce the negative impact of these risks on shrimp farming. Particularly, the forces from the external factors e.g natural disasters and diseases take significant stress on the risks, as it has happened in Aceh shrimp production after the tsunami 2004.

Two types of threats are identified to have significant impacts, and at the same time, having high probabilities. They cosisted of declining in shrimp selling prices as well as rising in shrimp production costs. These two threats are perceived by farmers triggering serious financial losses in every shrimp production cycle. Numerically, this research indicates the importance of further research related to risk assessment through a quantitative approach or a combination of both. Further research is also recommended in the aspect of identification on various types of existing risks as well as the effective and efficient management risks in shrimp farmings.

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