

Research Article

Risk Analysis in Salted Fish Agroindustry in Pusong Baru Village, Lhokseumawe City

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ABSTRACT

The salted fish agroindustry is one of the important economic activities for coastal communities in Lhokseumawe City, especially in Pusong Baru Village. This activity plays a role in increasing the added value of fishery products, but in its implementation it is faced with various risks that can affect business sustainability. These risks include production risk, market risk, and financial risk. This study aims to analyze the type and level of risk in the salted fish agroindustry in Pusong Baru Village, Lhokseumawe City. The research method used is a case study method with a descriptive approach. Data was collected through interviews, observations, and questionnaires to salted fish agroindustry players. Risk analysis is carried out by assessing the probability and impact of the risk, then mapping the level of risk using a risk matrix. The results of the study show that production risk and market risk are the highest level of risks, especially related to dependence on weather conditions and selling price fluctuations. Therefore, an appropriate risk management strategy is needed to support the sustainability of the salted fish agroindustry.

Keywords: Risk; Agroindustry; Salted Fish; Risk Management

1. INTRODUCTION

Fisheries agroindustry is one of the strategic sectors in national economic development, especially for coastal areas that have a high dependence on marine resources. This sector plays an important role in increasing the added value of fishery products through processing activities, job creation, and strengthening the local economy. According to Suseno et al. (2021), the fisheries agroindustry functions as a link between the primary production sector and the market, so that it can improve supply chain efficiency and strengthen the competitiveness of fishery products, especially at the small and medium business scale. Through agro-industrial activities, perishable fishery products can be processed into products with a longer shelf life and higher economic value. Widiastuti and Putri (2020) stated that the processing process of fishery products is the main strategy in reducing post-harvest losses and improving product quality before being marketed. Thus, agroindustry plays an important role in maintaining the continuity of the supply of fishery products and expanding the marketing reach.

The development of fisheries agro-industry also contributes to the economic resilience of coastal communities. Processing activities allow fishermen and coastal households to obtain alternative sources of income apart from the daily catch. According to Suryaningrum et al. (2022), the existence of fishery product processing units is able to reduce the economic vulnerability of coastal communities to seasonal and weather fluctuations, so that household income becomes more stable and sustainable. In addition, the fisheries agroindustry has a strong linkage with other sectors such as capture fisheries, trade, transportation, packaging, and services. This linkage creates a multiplier effect for the regional economy. Rachman and Huda (2023) explained that the development of the fisheries agroindustry in an area will encourage the growth of supporting sectors and increase the absorption of local labor, which ultimately contributes to improving community welfare.

One form of fisheries agroindustry that has long developed in Indonesia is the salted fish processing business. Salted fish is a traditional processed product that still has an important role in the food system of the Indonesian people. This product is popular because it is relatively affordable, easy to store, and can be processed into various types of dishes. According to Septiani et al. (2021), salted fish is a processed fishery product that is adaptive to the socio-economic conditions of coastal communities because the production process is relatively simple and does not require large capital. In terms of production, salted fish processing businesses can be run by small to medium-scale business actors with simple technology. Dwintasari and Pratiwi (2020) stated that the salted fish agroindustry plays an important role in the economic

empowerment of fishermen's households, especially women, because their production activities can be carried out in the household environment and are able to absorb local labor. However, salted fish processing businesses also have a relatively high level of uncertainty. The production process is highly dependent on the availability of fresh fish raw materials and weather conditions that affect the drying process. In addition, fluctuations in raw material prices and product selling prices also have an impact on the income of business actors. Rahmah and Yuliana (2022) stated that production risk and price risk are the main challenges in the salted fish agroindustry, so better business management is needed to maintain business sustainability.

Aceh Province is one of the regions in Indonesia that has great potential for fishery resources, supported by a long coastline and productive sea waters. This condition makes Aceh an important area in national fisheries production. The high production of fisheries in Aceh opens up great opportunities for the development of fisheries agro-industry, including salted fish processing businesses, because the availability of raw materials is the main factor in production sustainability. Azhar and Mahyuddin (2023) stated that the development of local potential-based fisheries agro-industry in Aceh has the potential to increase the added value of fishery resources and strengthen the economy of coastal communities.

Table 1. Production by Fish Type in Aceh Province, 2019-2023

No.	Types of Fish	Production Quantity Per Year (Tons)				
		2019	2020	2021	2022	2023
1.	Tuna/Skipper/Cob	110.89,35	111.978,05	150.343,11	151.527,40	142.938,99
2.	Snapper	21.179,81	21.391,61	28.679,73	28.809,16	21.813,19
3.	Cucut	426,27	430,53	577,21	577,79	687,88
4.	Bawal	4.183,13	3.224,96	4.323,70	4.328,03	22.934,78
5.	Teri	3.076,61	2.336,62	3.132,71	3.135,84	2.668,86
6.	Lemuru	687,46	920,89	1.234,64	1.235,87	1.846,66
7.	Bloating	9.422,91	9.517,14	12.759,63	12.772,39	11.772,39
8.	Mackerel	9.655,25	9.751,80	13.074,24	13.087,32	8.066,78
9.	Kuwe	5.244,09	3.276,33	4.392,57	4.396,97	3.124,20
10.	Baronang	2.281,31	1.304,12	1.748,44	1.750,18	1.841,32
11.	Yellow Tail	5.328,03	3.381,31	4.533,32	4.537,85	3.210,46
12.	Seal	19.461,15	19.655,76	26.352,48	26.378,83	20.378,21
13.	Crabs and Crabs	9.444,13	9.538,57	13.023,01	13.036,04	8.019,04
14.	Squid and Squid	573,95	579,69	791,45	792,24	986,88
15.	Lobster	4.475,94	4.520,70	6.172,11	6.178,28	6.134,32
16.	Other Fish	2.885,00	2.913,85	3.978,28	3.982,26	4.882,28

Source: Aceh Provincial Marine and Fisheries Service, 2024

However, fishery production in Aceh does not always take place in a stable manner. Production tends to fluctuate due to the influence of the fishing season, weather conditions, climate change, and other environmental and socioeconomic factors. In certain periods, fishery production can increase, while in other periods there is a significant decrease. These fluctuations directly have an impact on the continuity of the supply of fresh fish raw materials for fisheries agroindustry players, so that it has the potential to pose production risks, income risks, and business sustainability risks. The instability of raw material supply is a challenge for salted fish agroindustry players, especially small and medium-scale businesses that have limited capital and access to alternative raw material sources. When the supply of fish decreases, businesses are often faced with the choice of reducing production volumes or purchasing raw materials at higher prices, which can ultimately reduce business profits. To understand these conditions more comprehensively, accurate information is needed regarding the development and dynamics of fishery production. Fisheries production data can be used as an indicator to see the potential availability of raw materials as well as as a basis for identifying potential risks faced by the fisheries agroindustry in a region. Therefore, analysis of fishery production data is an important part of the study of the development and management of the fisheries agroindustry.

In an effort to provide an overview of the condition of fisheries production at the regional level, the following is presented data on fishery production in Aceh Province by type or region in recent years. The presentation of this data is expected to show trends and fluctuations in fishery production that occur, as well as provide an overview of the potential

availability of raw materials for the fisheries agroindustry. This information is an important basis in understanding the sustainability of salted fish processing businesses, especially those that develop in coastal areas such as Pusong Baru Village, Lhokseumawe City.

2. RESEARCH METHOD

This research was carried out in Pusong Baru Village, Lhokseumawe City. The location selection was carried out purposively with the consideration that the village is one of the salted fish agroindustry centers in the coastal area of Lhokseumawe City. The research was carried out within a certain period of time according to the needs of data collection. The type of data used in this study consists of primary data and secondary data. Primary data was obtained through direct interviews with salted fish agroindustry players, observation of the production process, and filling out questionnaires related to business risks. Secondary data is obtained from literature, related agency reports, and other supporting data. The analysis method used is risk analysis with a descriptive approach. The analysis stages include risk identification, risk and impact assessment, and risk level mapping using a risk matrix. The level of risk is obtained from the result of multiplying between the probability value and the impact value, which is then grouped into low, medium, and high-risk categories.

3. RESULTS AND DISCUSSION

Table 2. Probability and Risk Impact Assessment Scale

Shoes	Probability	Impact
1	Very Rare	Very Small
2	Rare	Small
3	Quite often	Medium
4	Frequent	Large
5	Very Often	Very Large

Table 4. Risk Matrix

Impact/ Probability	1	2	3	4	5
5	Low	Medium	Height	Height	Height
4	Low	Medium	Medium	Height	Height
3	Low	Medium	Medium	Medium	Height
2	Low	Low	Medium	Medium	
1	Low	Low			

Based on the results of in-depth interviews with business actors and direct observations in the field, the risks faced by the salted fish agroindustry in Pusong Baru Village can be classified into three main groups, namely production risk, market risk, and financial risk. These three types of risks are interrelated and together affect the sustainability of the salted fish agro-industry business in the region. Production risk is the most dominant risk felt by business actors. The uncertainty of the availability of fresh fish raw materials is a major problem, especially because the supply of fish is highly dependent on fishermen's catches which are influenced by the season and water conditions. In bad weather seasons, fishermen tend to reduce their seagoing activities so that the number of fresh fish available in the market decreases significantly. This condition causes agroindustry players to not be able to produce optimally or even be forced to stop production temporarily. Based on the results of interviews and field observations, it is known that the production capacity of salted fish agroindustry in Pusong Baru Village ranges from 1 ton to 1.5 tons of fresh fish raw materials for each production process, with an average processing time of 2-3 days, depending on weather conditions and the type of fish processed. This production volume shows that the salted fish agroindustry in the study area has been operating on a small-medium scale, with a relatively high level of production intensity in a single processing cycle.

The large volume of raw materials processed in one production process has direct implications for the level of production risk faced by business actors. On a production scale of 1–1.5 tons, the dependence on the availability of fresh fish raw materials is very high. If the supply of fish is disrupted, either due to bad weather or a decrease in fishermen's catches, then the production capacity cannot be fulfilled optimally. This condition causes business actors to face the risk of losing a large amount of production potential in one cycle, considering that the production process cannot be carried out partially without affecting business efficiency. In addition, the duration of the production process, which takes 2–3 days, increases the exposure to risks from environmental factors, especially the weather. The drying process that still relies on sunlight causes the success of production to be largely determined by the intensity of heat and the level of humidity of the air during that period. In erratic weather conditions, such as rain or prolonged clouds, the fish being processed is at risk of not drying

completely. With large production volumes, the failure of the drying process not only degrades the quality of some of the products, but can also result in significant amounts of product damage, thereby increasing the potential for economic losses. From the perspective of production management, the larger the production volume in a cycle, the greater the impact caused by production disruptions. This explains why production risks, particularly those related to weather dependence and degraded product quality, obtain high risk values in risk matrix analysis. On a production scale of 1–1.5 tons, a small error in the processing process or a delay in drying can have an impact on hundreds of kilograms of salted fish products that do not meet market quality standards.

Relatively large production capacity also affects market risk. The volume of output produced after the processing process demands that there is a market that is able to absorb the product quickly and sustainably. However, the results of the study show that the selling price of salted fish tends to fluctuate and is greatly influenced by supply conditions in the market. When many business actors produce salted fish at the same time, usually in the abundant fish season, the increase in production volume is not always followed by an increase in income, because the selling price actually decreases. In these conditions, agroindustry players who produce up to 1.5 tons per cycle face a dilemma between selling products at low prices or delaying sales with the risk of quality degradation. The length of the production process which reaches 2-3 days also limits the flexibility of business actors in responding to rapid changes in market prices. As a result, the risk of price fluctuations becomes increasingly significant, as production decisions must be made before the certainty of selling prices can be predicted. In terms of financial risk, the production scale of 1-1.5 tons requires relatively large working capital, especially for the purchase of fresh fish raw materials, labor costs, and operational costs during the processing process. However, most agroindustry players still rely on their own capital without formal financing support. This condition causes the ability of business actors to bear the risk of loss to be limited. If in one production cycle there is a failure or decrease in product quality, the losses incurred will directly affect the sustainability of the business in the next production cycle.

Thus, the results of the study show that the high production volume per cycle (1–1.5 tons) and the length of the production process (2–3 days) structurally increase the risk level of the salted fish agroindustry in Pusong Baru Village. Production risk, market risk, and financial risk do not stand alone, but are interrelated and strengthened by the characteristics of business scale and processing technology that are still simple. These findings confirm that increasing production capacity without being balanced with risk management and technology support can actually increase business vulnerability. In addition, the process of drying salted fish in Pusong Baru Village is still highly dependent on sunlight. Dependence on these weather conditions poses its own risks, especially in the rainy season or when the air humidity level is high. Imperfect drying processes can degrade the quality of the product, such as the appearance of unpleasant odors, less dry textures, or unattractive product colors. Traditional processing techniques and limited supporting equipment also contribute to the risk of product quality degradation. As a result, both the quantity and quality of salted fish produced tend to decline in certain periods. Market risk is closely related to price volatility and consumer demand dynamics. The selling price of salted fish in Pusong Baru Village tends to fluctuate, influenced by the amount of fresh fish supply, the production season, and general market conditions. When the supply of fish is abundant, the price of salted fish tends to fall due to the increasing production volume in various regions. Conversely, when supply is limited, prices can increase but sales volumes often decrease due to limited consumer purchasing power.

Changing consumer tastes and demands are also a challenge. Consumers are increasingly paying attention to the aspects of quality, cleanliness, and food safety, while some business actors still do not apply consistent processing standards. In addition, competition with salted fish products from other regions that have better processing technology or a wider marketing network has also narrowed the market share of local business actors. This condition causes the income of salted fish agroindustry players to be uncertain and difficult to predict from time to time. Financial risk is a structural risk that has a long-term impact on business development. Most of the salted fish agro-industry players in Pusong Baru Village still rely on their own capital in running their businesses. Capital limitations make it difficult for business actors to increase production capacity, improve processing facilities, or adopt more efficient and hygienic technology. Reliance on private capital also makes businesses vulnerable to shocks, such as losses due to bad weather or declining market prices. Access to formal financing institutions, such as banks or cooperatives, is still very limited. This is due to various factors, including the absence of collateral, low financial literacy, and administrative procedures that are considered complicated by business actors. As a result, the opportunity to obtain additional business capital becomes increasingly narrow. This limited financial condition ultimately hinders efforts to increase the business scale and competitiveness of the salted fish agroindustry in Pusong Baru Village. Overall, production risks, market risks, and financial risks are real challenges faced by the salted fish agroindustry in Pusong Baru Village. Without a proper risk management strategy, these three types of risks have the potential to hinder business sustainability and the welfare of agroindustry actors, therefore, support from various parties, both local governments, financial institutions, and business assistants, is needed to help agroindustry actors in minimizing risks and increasing their business resilience.

Risk Level Analysis Using Risk Matrix

The assessment of the risk level in the salted fish agroindustry in Pusong Baru Village was carried out using a risk matrix analysis tool, by combining the probability (P) and impact (D) values of each risk. The probability and impact assessment

scale uses a range of values 1–5, where a value of 1 indicates a very low level and a value of 5 indicates a very high level. The risk level (R) is obtained from the result of multiplying between probability and impact ($R = P \times D$).

Table 5. Probability and Risk Impact Assessment Scale

Score	Probability	Impact
1	Very Rare	Very Small
2	Rare	
3	Quite often	Medium
4	Frequent	
5	Very Often	Medium Large

Based on the results of interviews and questionnaires with salted fish agroindustry players, a probability and impact assessment was obtained for each type of risk as presented in Table 2.

Table 6. Results of the Salted Fish Agroindustry Risk Assessment

Risk Type	Probability (P)	Impact (D)	Risk Level (R)	Category
Uncertainty of fish raw materials	4	3	3	Height
Weather dependence	3	4	4	Height
Degradation of product quality	5	4	20	Medium
Selling price fluctuations	3	4	12	Height
Market competition	4	16	9	Medium
Limited business capital	3	9	16	Medium

The results of the analysis showed that production risks, especially the risk of dependence on weather conditions and uncertainty of fish raw materials, had the highest risk value. Market risk in the form of selling price fluctuations is also in the high-risk category. Financial risks, such as limited working capital, are in the category of moderate risk. To facilitate the visualization of the level of risk, risk mapping is carried out using the risk matrix as shown in Table 7.

Table 7. Salted Fish Agroindustry Risk Matrix

Impact/Probability	1	2	3	4	5
5			Height	Height	
4		Medium		Height	Height
3	Medium		Medium		Height
2	Low		Medium		
1	Low	Low			

The results of the study show that the high production risk and market risk in the salted fish agroindustry in Pusong Baru Village are a structural consequence of the characteristics of businesses that are still small-scale, low-tech, and highly dependent on natural factors. In the perspective of production risk management theory, the high dependence on external variables that cannot be controlled such as weather and the availability of raw materials places business actors at a high level of uncertainty, as variations in production output cannot be accurately predicted. Production risks in the salted fish agroindustry mainly come from the processing process that still relies on natural drying methods. The dependence on sunlight as a major factor in the drying process causes the production success rate to be very sensitive to changing weather conditions. In the perspective of production theory, especially in the stochastic production frontier approach, the uncertainty of environmental inputs such as rainfall, air humidity, and sunlight intensity will increase output variance and decrease technical efficiency. This happens because business actors are not able to fully control these external factors, so the inputs used do not always produce outputs according to their maximum potential. Erratic weather conditions cause a discrepancy between the production plan and the realization of output, both in terms of volume and product quality. Salted fish that is not optimally dried is at risk of experiencing quality degradation, such as discoloration, unwanted aroma, and an increased risk of product damage before being marketed. The continued impact of this condition is an increase in the rate of production losses as well as increased indirect costs, such as additional labor costs and longer production times. This situation reinforces the argument that production risks in traditional agroindustries are not solely caused by natural factors, but also by the limited adoption of technologies that serve as risk mitigation tools.

In addition to the risks arising from the production process, the dependence on seasonal fresh fish raw materials reflects the weak management of the supply chain on the upstream side. In the framework of supply chain management, the sustainability of production is largely determined by the stability of the main input supply. The uncertainty of the availability of fresh fish raw materials, both in terms of quantity, quality, and price, increases operational risks for the salted fish processing agroindustry. Small-scale business actors generally do not have cold storage capacity or long-term

supply contracts, so they are completely dependent on fishermen's daily catch and fishing season conditions. Fluctuations in the supply of raw materials have direct implications for the instability of production costs. When the supply of fish is abundant, the price of raw materials tends to fall, but the quality of fish is often not uniform. On the other hand, when supply is limited, the price of raw materials increases and forces business actors to reduce profit margins or even reduce production volumes. In the long run, this condition reduces the ability of business actors to plan production sustainably and increases exposure to financial risks. Therefore, production risk and market risk in the salted fish agroindustry do not stand separately, but interact with each other and reinforce each other.

In terms of market risk, the salted fish agroindustry in Pusong Baru Village is in a relatively weak bargaining position in the market structure which tends to be local oligopsony, where the number of buyers or collectors is less than the number of producers. Based on market structure theory, this condition places business actors as price takers who do not have the ability to influence the selling price of their products. The price of salted fish is generally determined by the buyer based on daily market conditions, local demand, and the quality of the product in general, rather than through an equivalent negotiation mechanism. The low level of product differentiation further magnifies marketing risks. Salted fish products are treated as homogeneous commodities with relatively low added value, so competition between producers occurs more in terms of price. Limited access to market information, such as price developments in other regions or non-local market opportunities, make it difficult for business actors to make strategic marketing decisions. As a result, agroindustry players tend to sell products in distress selling, especially when production accumulates or product quality decreases due to weather constraints.

These findings are in line with small-scale agro-industry theory which states that limited capital, technology, managerial capacity, and marketing networks cause high risk exposure in production and marketing aspects. The risks faced are not incidental or temporary, but systemic because they are attached to the traditional business model that is run. In this context, risk can be categorized as structural risk, which is a risk that arises due to a combination of internal business factors and the external environment that is beyond the direct control of business actors. Therefore, risk management efforts in the salted fish agroindustry in Pusong Baru Village are not enough to be carried out through short-term or reactive approaches, such as reducing production during bad weather or selling quickly at low prices. Risk management needs to be directed at the gradual and integrated transformation of production and marketing systems. Within the risk management framework, improvements in drying technology, such as the use of solar dryers or semi-mechanical drying technology, serve as a risk mitigation strategy to reduce the probability of production failures due to dependence on the weather. In addition, diversifying raw material sources and strengthening partnership relationships with fishermen or fish suppliers is a form of risk reduction strategy that aims to reduce dependence on one source of input. This strategy can increase production flexibility and improve the stability of raw material supply in the long term. From a marketing perspective, strengthening marketing networks, whether through cooperatives, joint venture groups, or the use of digital marketing channels, can help expand market access and reduce dependence on local buyers. Increasing product differentiation through quality improvement, packaging, and development of salted fish product variations is also an important strategy in reducing market risk. By creating added value, business actors can improve their bargaining position and reduce their sensitivity to price fluctuations. Theoretically, these measures are in line with risk management principles that emphasize increasing business flexibility, strengthening adaptive capacity, and reducing structural vulnerability. Thus, integrated risk management has the potential to increase the sustainability of the salted fish agroindustry in Pusong Baru Village, both from an economic, social, and institutional perspective, in the long term.

4. CONCLUSION

The salted fish agroindustry in Pusong Baru Village, Lhokseumawe City, faces various business risks that come from production, market, and financial aspects. Production risk and market risk are the dominant risks with the highest level of risk, especially related to dependence on weather conditions in the drying process and volatile fluctuations in selling prices at the market level. This condition shows that the sustainability of the salted fish agroindustry business is greatly influenced by external factors that are difficult for business actors to control directly. It is recommended to salted fish agroindustry players to improve business management through diversification of raw material sources, the application of alternative drying technologies that are more adaptive to weather changes, and strengthening marketing management to expand market reach and improve product bargaining positions. These efforts are expected to be able to reduce the level of business risk while increasing the efficiency and competitiveness of the salted fish agroindustry. In addition, stronger synergy is needed between business actors, local governments, and other supporting institutions so that risk management efforts can run effectively and sustainably. Local governments are expected to provide support through training programs, continuous mentoring, and facilitation of access to capital and production facilities. With this support, the salted fish agroindustry is expected to be able to increase business resilience, maintain production sustainability, and make a greater contribution to increasing the income of business actors and the local economy in Lhokseumawe City.

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