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Driving factors of Indonesian import of fish meal

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Abstract. Fish meal is an imported raw material for feed industry in Indonesia. This study aims to analyze driving factors and control strategies of fish meal import. Primary and secondary data were used by exploring time series data and interviewing some actors in the feed industry in Surabaya and DKI Jakarta. Data and information were analyzed using the Fishbone Diagram and Analytical Hierarchy Process (AHP) method. The results indicate that Indonesian fish meal import is driven by internal and external factors: low production, low protein contents and certification of local fish meal, export barriers, and the continuity of fish supplies. The AHP method provides three strategies for controlling Indonesian import of fish meal: 1) to increase the production of local fish meal; 2) to utilize fish supplies from catching practices as fish meal; and 3) to assist and facilitate the local fish meal industry for quality certification. This study offers some policy recommendations: improving national system of fish logistics to maintain continuity and availability of fish supplies for the local fish meal industry, initiating collaboration between governments and private sectors on developing medium-scale fish meal industry by utilizing fresh fish supplies, and assisting fish meal industry to implement quality standard and certification.

1. Introduction

The role of aquaculture is getting bigger in providing fish for public consumption [1]. This increasing role is in line with the decrease in marine fish resources so that fishing activities tend to be limited. One of the challenges of aquaculture is how to meet the need for fish feed that is efficient and of quality at an affordable price. This issue becomes important related to feed input which is the largest constituent in the structure of the production cost of fish farming, which reaches more than 70% [2].

Pellet feed is the most important factor in increasing the growth and development of cultivated biota. Feed has an important role as a source of energy for body maintenance, fish growth and reproduction. Fish meal is the main raw material used as a protein source in artificial feed because it has a protein content of 64% [3]. However, fish meal is a limited and expensive source of raw material because the fish meal that is widely used comes from imports [4].

The problem that arises is that the price of manufactured feed, which is generally used by fish cultivators, tends to show an upward trend. As a result, current cultivation businesses tend to be inefficient because production costs for feed continue to increase. This condition is triggered by the limitations of the feed industry in utilizing local raw materials to be used as fish feed. The facts show that the feed industry still depends heavily on imported feed raw materials, especially fish meal [5].

Based on the data and information obtained in this study, fish feed industry players with fish meal as one of the main raw materials are around 7% -9% in feed production. With the production volume of manufactured fish feed production in 2018 of 1.65 million tons, the average need for fish meal is



132,000 tons. Meanwhile, local fish meal production is only 60,000 tons. Thus, the feed industry players must meet the shortage of local fish meal supply with as much imported fish meal.

The dependence of fish feed industry players on imported fish meal is 68% due to the low supply of fish meal in the country. The need for domestic fish meal has not been met with a large deficit (deficiency) of 160,390 tons in 2018 [6]. This indicates that the national fish feed industry is still operating below its optimal production capacity. This means that the fish feed industry operates with a maximum production capacity of 50% compared to its installed capacity. This is a challenge in itself for the government in its efforts to develop domestic aquaculture.

The main exporters of fish meal in 2016-2018 were the United States, South Korea, Thailand and Vietnam. In previous years, Peru and Chile were the main exporters of fish meal in Indonesia. However, the dominance of the two countries appears to be decreasing compared to that of the United States and South Korea as indicated by the large share of their market in Indonesia. This was triggered by the import price of fish meal from Peru and Chile in the same period which was the highest price compared to its competing countries. On the other hand, import prices for fish meal from the United States and South Korea are the lowest prices among major fish meal exporters in Indonesia. A different condition occurred in 2018 where the dominance of imports from Thailand and China showed an increase, while the market share of other major exporters actually decreased. This is again due to the fact that the import prices belonging to Thailand and China are the lowest prices offered in Indonesia.

The dependence of the fish feed industry on imports of fish meal in the period 2016-2018, showing a decline, both in terms of volume and value of imports. The growth in volume and value of imports was minus 2.78% and minus 11.32% per year, respectively. Volume and value of fish meal imports in 2017 decreased 24% and 27% respectively compared to 2016 to 104,103 tons and USD 88.91 million. However, it increased again in 2018 by 25% and 10% compared to 2017 to 129,609 tons and USD 97.78 million. Based on this background, this study aims to analyze the driving factors for the import of fish meal which will then formulate an import control strategy so that Indonesia's dependence on imports of one of the important fisheries commodities in the fisheries industry.

2. Methods

The research was conducted in August-September 2019 with a survey approach in two big cities, namely DKI Jakarta and Surabaya, East Java. The data used are primary and secondary data. Secondary data in the form of statistical data from FQIA, documents, literature, scientific journals, relevant previous study reports were obtained through literature searches. Primary data were obtained through direct observation and interviews with four fish/livestock feed industry players located in Surabaya and Jakarta. The sampling method is based on a survey technique approach where the collection of information and knowledge from respondents uses a purposive sampling method (directed sampling).

The collected data were then analyzed with a fishbone diagram to show the factors causing the high performance of imports of Indonesian fish meal. The fishbone diagram or Ishikawa diagram is a tool to identify various potential causes of a problem so that the consequences can be identified and further corrective action is taken [7,8]. This diagram is called a fishbone diagram because it is shaped like a fish skeleton which is depicted with lines and symbols that show the relationship between the consequences and causes of a problem [9].

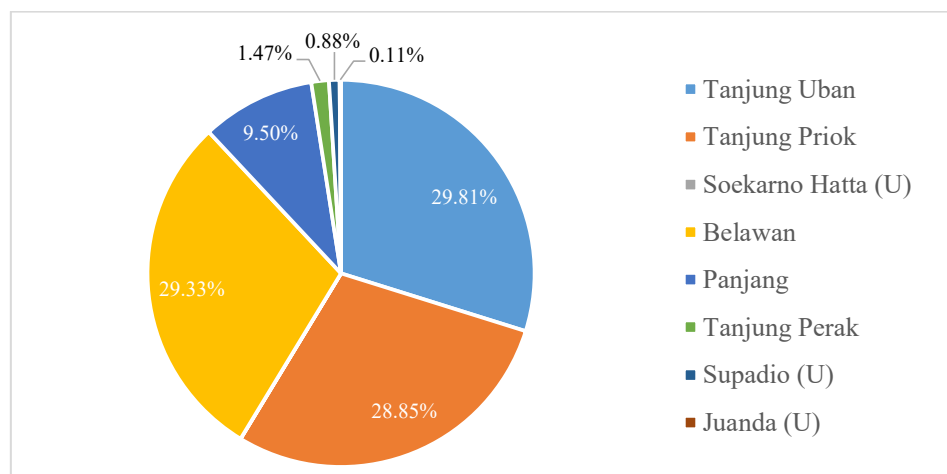
Another analytical method used is the analytical hierarchy process (AHP) to formulate a control strategy for Indonesian fish meal imports. AHP is used to derive the ratio scale of several paired comparisons that are discrete or continuous. Therefore, this method is very useful to help get a ratio scale of things that were difficult to measure at first, such as opinions or perceptions, feelings, behaviors, and beliefs [10]. This study uses the AHP method with primary data in the form of perceptions or information on the problems faced by respondents in the fish feed industry. Data and information were obtained through filling out questionnaires, interviews and observations in several companies that use fish meal in producing fish feed. The AHP method intelligently applies a complex

mathematical approach, but is based on a qualitative approach that can be accepted by all stakeholders. The use of AHP is expected to obtain priority options or alternatives from policies that can be implemented by policy makers [11].

3. Results and discussion

3.1. Distribution and import designation

Most of the fish meal import activities are carried out through sea and air transportation, so that the entry points for imports are ports and airports throughout Indonesia. Based on Statistics Indonesia data (2019), the entrance to fish meal imports is centered on five sea ports, namely Tanjung Uban in Batam, Belawan in Medan, Tanjung Priok in Jakarta, Panjang Port in Lampung, and Tanjung Perak in Surabaya. The main entrances are also made at Soekarno Hatta Airport in Jakarta, Juanda in Surabaya, and Supadio in Pontianak. Figure 1 shows that the biggest entry point for imports during 2016-2018 period was Tanjung Uban in Batam with share of 29.81% of the total imports of fish meal to Indonesia. The next gate which also has a very important role is Belawan Port in Medan (29.33%), Tanjung Priok in Jakarta (28.85%), and Panjang Port in Lampung (9.50%). Figure 1 can also be seen that almost all imports of fish meal (99%) enter through sea ports and the rest is sent through airports (1%). This is due to the form factor of the imported product in the form of a powder so that long delivery does not affect for quality of the goods. In addition, the price factor which is cheaper than the cost of shipping by airplane makes importers prefer sea transportation.



Source: SI, 2019

Figure 1. Main Entrance for Fish Meal Import 2016-2018.

Figure 1 shows that the three main ports of entry are located in the cities of Batam, Jakarta and Medan. Of the three big cities, Medan City shows the entrance which has continued to increase its role in the last three years. In 2016, Belawan's contribution as an entry point was 13% and more than doubled, namely by 38% in 2017, but decreased slightly in 2018 to 36%. On the other hand, Tanjung Priok actually shows a decline in its role every year where it plays a role of 35% in 2016 to only 23% in 2018. Meanwhile, the role of Tanjung Uban in Batam has decreased its role to 21% in 2017, but has increased back to 30% in 2018. This is due to the fact that the position of importers is spread across Medan, Batam and Lampung.

Whole or 100% imported fish meal is intended and used as raw material for feed, both fish feed and other animal feed. Fish meal contributes about 7-9% of all components used in producing fish feed. Other raw materials used include soybean meal, palm oil bran, rice bran, tapioca, and fish oil [12]. Due to the role of fish meal as a raw material for fish feed, the distribution and designation of

imports is channeled to feed factories scattered in the shipping port cities. Based on Fish Quarantine and Inspection Agency data [13], most importers were in Jakarta and Medan during 2016-2018. On average, the number of importers in Jakarta is 19 companies, Medan with 11 companies, Surabaya with 10 companies, and Lampung and Semarang having the same number of importers, namely three companies. In detail, the designation of imported fish meal is shown in Table 1.

Table 1. Distribution and Allocation of Imported Fish Meal by Region 2016-2018.

Major Cities	Average Number of Importers	Average Share of Imports (%)
Jakarta	19	28.46
Lampung	3	7.08
Medan	11	43.20
Semarang	3	1.77
Surabaya	10	19.49

Source: FQIA, 2019

Table 1 shows that the largest portion of imported fishmeal is distributed in Medan, amounting to 43.20%, which is distributed to 11 companies and as much as 28.47% in Jakarta for 19 companies. The third largest distribution is in the city of Surabaya as much as 19.49% for 10 companies. The interesting thing is that Medan is the main gateway with the largest portion, but the number of companies that use imports of fish meal is actually less than the number of users in Jakarta. This indicates that the location of many factories in Jakarta is not followed by the amount or volume of imported fish meal which is used as raw material. Meanwhile, fish feed factories in Medan are the biggest users of imported fish meal. This is due to the location of aquaculture which is widely spread in Medan and areas on the island of Sumatra.

3.2. Driving factors of fish meal imports

The analysis previously described shows that the national feed industry has not been able to escape dependence on imports of fish meal, which is one of the important raw materials. Several aspects are suspected to be the main driving factor. Based on the information obtained, this dependence on imported fish meal is driven by at least four factors, namely the lack of local production, low local high protein flour, export barriers, and resources. The identification of these import drivers is presented in detail in Figure 2.

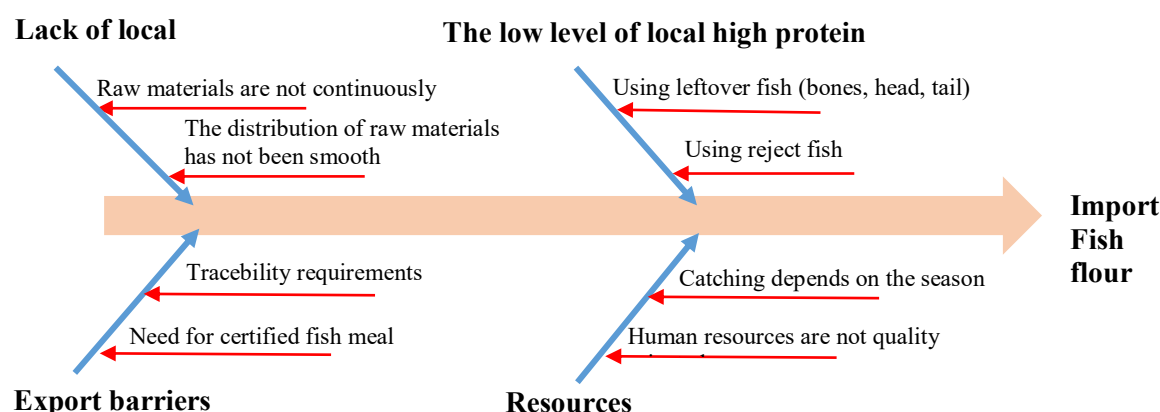


Figure 2. Identification of the driving factors for fish meal imports.

3.2.1. Lack of volume of local fish meal production. The manufacture of fish feed relies heavily on fish meal because it is a determining factor for the quality of artificial feed and a source of animal protein. Fish meal generally uses a variety of raw materials such as trash fish or fish that are still intact, but not suitable for consumption and the residual use of fish from fish processing factories, such as canned fish factories or tuna meat processing factories so that the unused fish parts are used as ingredients raw fish meal. This raw material for fish meal contains high protein so that it is used as a protein source that can provide growth in fish.

The problem that arises is that the production of trash fish continues seasonally. This means that the availability of trash fish in abundance does not occur throughout the year but follows the fishing season cycle. Because the continuous availability of trash fish is very difficult to fulfill, the next impact is that the fish meal processing business has difficulty obtaining the main raw material from trash fish or by-products from fishing activities. The difficulty in obtaining trash fish in the manufacture of local fish feed ultimately affects the fish feed industry, which makes fish meal the main raw material.

This problem encourages the fish feed industry to meet the need for fish meal from imports for the sake of production activities. Based on information from fish feed business actors, local fish meal is preferred over imported fish meal, especially for fresh fish feed which does not require too high a protein. In addition to being easier to obtain in a shorter time, the price factor is also a consideration where local fish meal certainly has a cheaper price. Thus, business efficiency can be achieved considering that fish meal is one of the main components in fish feed production. However, the actual condition of local fish meal production is inadequate, so this factor is what drives the fish feed industry to import fish meal.

3.2.2. The low level of local high protein fish meal. The fish feed produced is designated based on the type of fish being cultivated so that the protein content required is also different for each type of fish. Based on information from fish feed business operators, freshwater fish tend not to need a high protein content, but seawater fish instead need feed with a high protein level ($> 30\%$), such as white snapper, pomfret, grouper and shrimp. Meanwhile, it is acknowledged that local fish meal does not contain sufficient protein for marine fish feed, so that the need is fully obtained from imported fish meal. For this reason, local fish meal can still be used to feed freshwater fish such as catfish, tilapia, goldfish and carp.

On the other hand, imported fish meal is recognized as having a high protein content ($> 30\%$) so that the need for seawater fish feed can be met from imported fish meal. It is admitted that imported fish meal can contain high protein because the raw material used for fish meal is the main catch, not fish that has been deteriorated in quality. In fact, information has been obtained that the raw material for fish meal is salmon which is generally used as the main consumption product. On the other hand, local fish meal uses trash fish that have been used as consumption residues or fish bones and heads that are not utilized in fish processing. Fish meal derived from trash fish is rich in amino acids, energy, fatty acids and minerals and contains attractants that can increase fish appetite [14].

The need for high protein fish meal is a driving factor for imports of fish meal. The high amount of imported fish meal causes the price of flour to become more expensive, which creates a problem for the development of fisheries business. Therefore, to overcome this, an alternative source of animal protein is needed which is relatively cheap, available at all times, and of good quality. One alternative to minimize dependence on fish meal is to use trash fish, salted fish, and fish heads which have the potential as one of the local feed ingredients because they contain protein levels ranging from 25–75% [12]. The protein content of each material is high and can meet the protein needs in the body of the fish. It is hoped that this material can become a substitute for the use of fish meal in fish feed which is currently imported.

3.2.3. Export barriers. Marine aquaculture products generally become Indonesia's mainstay export commodities, such as grouper, snapper and shrimp. Since 2010, free trade which is characterized by

various free trade areas has implemented export requirements regarding the origin of exported products as a guarantee of safety and health of the food to be consumed [15]. This is no exception with cultivation commodities that use various production inputs, which must meet these requirements, which are represented by certificates that guarantee the quality of the inputs used, including fish feed. This phenomenon encourages the local feed industry to require certified fish meal so that the fish feed it produces can be used by marine fish cultivators as input for their production.

The problem is, it is acknowledged that no local fish meal has the requested certificate, on the other hand, imported fish meal has pocketed the certificate. This condition makes national fish feed industry players have no other choice but to import certified fish meal. As an illustration, the need for shrimp feed can be seen from the feed conversion ratio (FCR) of shrimp to national shrimp production which is 1.5 [16]. In 2018, the total production of Indonesian *Litopenaeus vannamei* shrimp was 555,138 tons, so the need for shrimp feed was 832,707 tons. With the composition of fish meal in feed production an average of 8%, the need for fish meal is 66,616 tons. Based on these calculations, the import needs for shrimp feed account for 51% of the total imports of Indonesian fish meal.

The problem of unavailability of certified local fish meal is one of the driving factors for the national feed industry to continue importing fish meal. This is a big job for the government in order to control fish meal imports in the future. The government must work hard to encourage the local fish meal industry to produce fish meal in accordance with international standards and also use traceable raw materials so that it meets the traceability aspect.

3.2.4. Resource. Resources that become obstacles in the production of local fish meal consist of fish resources and human resources, namely fishermen and crew who catch fish in the sea. As is the case with agricultural commodities, fish is also a commodity whose production is highly dependent on the fishing season so that the availability of raw materials is highly dependent on the season. Season becomes the main obstacle in the supply of marine fish as raw material for local fish meal in the country. According to industry players, raw materials tend to be available in abundance during the west wind season which causes wind and sea waves to be very conducive to fishing. On the other hand, fishermen cannot catch fish during the east wind season so that the raw material is not available or very little is available. Another problem is that the availability of fish for fish meal must compete with the need for fish for public consumption because there is no fishing which is specifically used for fish meal as raw material.

Human resources are also an obstacle because fishermen or crew members tend not to pay attention to the quality of the fish they catch. Handling or handling of catches generally does not follow the applicable quality standards so that the quality or condition of the fish caught is often damaged. Catching after catching also has not fully used adequate equipment and equipment so that the fish is not fresh. The condition of this fish will then affect the quality of the fish meal produced, both in appearance and in protein content. For this reason, it is necessary to increase the knowledge and skills of fishermen and crew members in post-fishing handling and using appropriate fishing technology through various trainings so that the landed fish is still in fresh condition with high quality.

3.3. Fish meal import control strategy

Based on the results of the FGD with key informants who have knowledge and experience in the import of fish meal, there are four main factors that influence the fish meal import control strategy undertaken by business actors. The four strategies are viewed from the aspects of the economy, policies, resources and infrastructure. The actors that are considered influential in the import activities are the government, in this case the Ministry of Marine Affairs and Fisheries and business actors. Then, the objectives to be achieved in this research include increasing the production of domestic fish meal, and increasing the quality of fish meal produced by domestic producers, and encouraging certified domestic fish meal. Finally, the alternative strategies that can be chosen are related to fish meal import control strategies, namely improving the national fish logistics system and utilizing local raw materials, using high protein fish for local fish meal, assistance and facilitation related to local fish

meal certification, and increasing human resource competence related to technology and post-production handling. The following is the hierarchical structure of the import control strategy produced by this study, which can be seen in Figure 3.

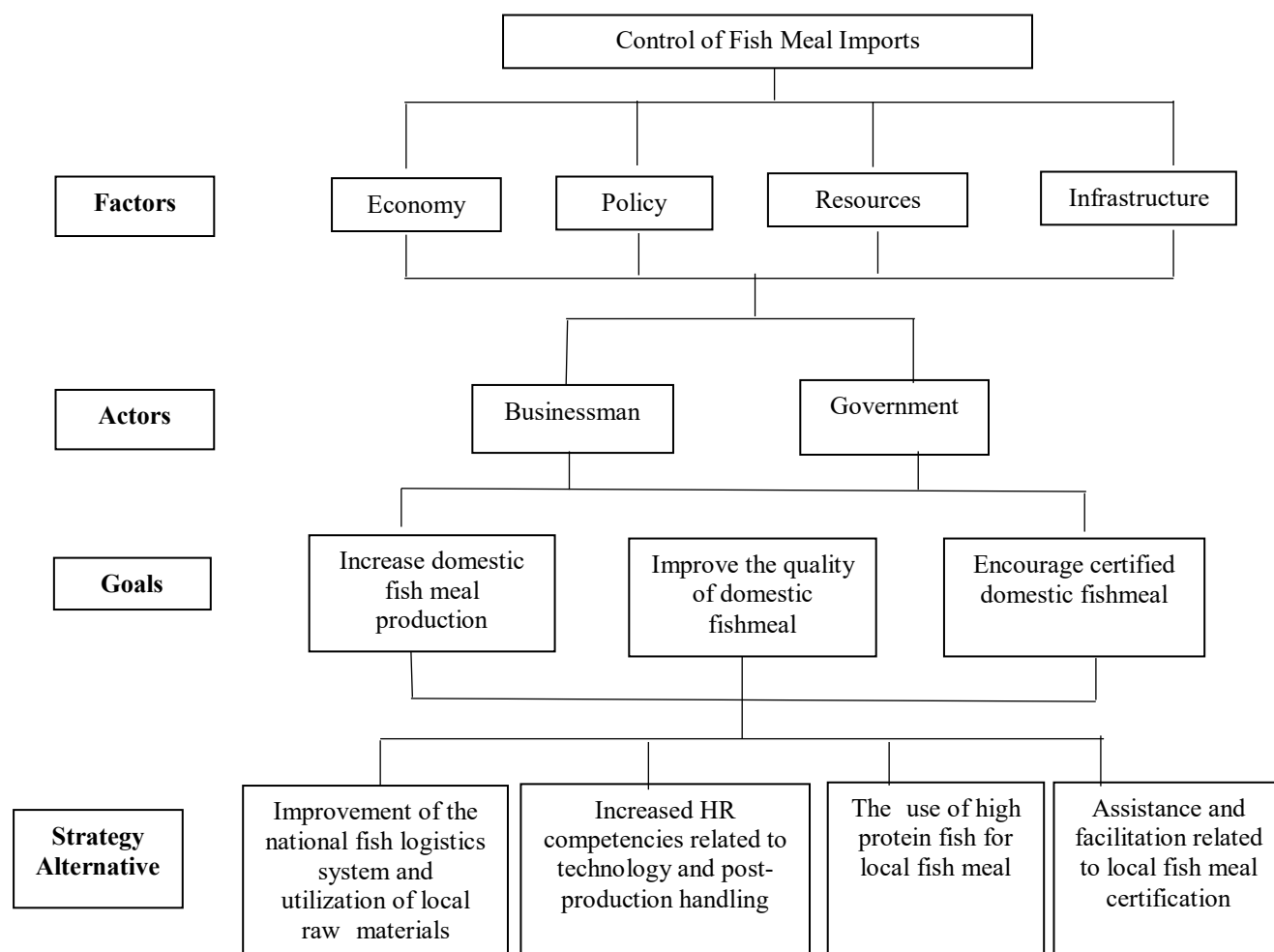


Figure 3. Hierarchical structure of fish meal import control strategy.

3.3.1. Horizontal level actor processing results. Processing at the actor level shows the level of influence of actors on factors. Actor level calculations can be seen in the table below.

Table 2. Results of actor level horizontal processing.

Actors	Factors			
	Economy	Policy	Resources	Infrastructure
Government	0.773	0.853	0.457	0.788
Businessman	0.227	0.167	0.543	0.212

Source: primary data, 2019 (processed)

Table 2 shows that the government (0.773) is fully responsible from an economic point of view, such as looking for ways to control imports of fish meal that are not detrimental to business actors as well as the government. Meanwhile, in the policy factor (0.853), the government has full power to determine what policies will be taken regarding this fish meal import issue, and this also applies to the

infrastructure side (0.788). The construction of a local fish meal factory is expected to be one of the solutions to reduce the high amount of fish meal imports so far. Meanwhile, the factor of business actors' resources, namely fish meal producers, is responsible for its fulfillment. Resources here include fish and human resources. The difficulty of obtaining good fish resources as raw material for fish meal has been one of the driving factors for fish meal imports so far.

3.3.2. Goal level horizontal processing results. Processing at the objective level is to show the level of influence of the actors on the objectives of this research on fish meal import control. Calculation of the level of objectives can be seen in Table 3.

Table 3. Processing results at the goal level.

Goals	Actors							
	Economy		Policy		Resources		Infrastructure	
	Govern ment	Busin essma n	Govern ment	Business man	Governm ent	Business man	Governm ent	Business man
Increase local fish meal production	0.441	0.203	0.492	0.145	0.393	0.142	0.506	0.140
Improve the quality of local fishmeal	0.313	0.428	0.309	0.535	0.302	0.493	0.269	0.543
Encourage certified local fishmeal	0,246	0.369	0.199	0.320	0,305	0.366	0.224	0.317

Source: primary data, 2019 (processed)

Table 3 shows that for each objective there are different interests and priorities of each actor involved, namely the government and business actors. For the first objective, namely reducing imports of fish meal and replacing it with local fish meal, the table shows that this goal is the main focus of the Government from any perspective. This can be seen in the weighting value carried out by the government which is higher than that of business actors. To make it happen, the government has taken various methods so that the import volume of fish meal will decrease every year. Meanwhile, the condition is inversely proportional to the second objective of increasing domestic fish meal production, where in table 2 it can be seen that for this purpose the value weight of business actors is greater than the government in each sector. This shows that business actors are more focused on how to increase domestic fish meal production so that they are able to meet the needs of fish feed producers. From the fishmeal producer side, they also have the same opinion that if the quality and quantity of domestic fishmeal can meet their needs, they will still choose domestic products because from the side of operational costs it will be cheaper.

The last objective is to improve the quality of domestic fish meal is actually the focus of both the government and business actors. However, based on the weighting shown in the table above, the value of business actors is higher than that of the government. This is related to the feed requirements for export commodities that must use certified feed, while the majority of domestic fishmeal currently has no clear certification and the raw materials used are still difficult to record regarding its traceability. This condition makes business actors prioritize to start looking for ways to improve the quality of the fish meal produced.

3.3.3. Horizontal level strategy processing results. Processing at the strategic level shows the level of influence of the strategy on the main objective. The results of the strategy level processing can be seen in Table 4.

Table 4. Results of strategy level processing.

No.	Subsector	Policy Alternative			
		Alt 1	Alt 2	Alt 3	Alt 4
1.	Economy	0.365	0.133	0.229	0.225
2.	Policy	0.330	0.272	0.271	0.272
3.	Resources	0.377	0.166	0.214	0.243
4.	Infrastructure	0.284	0.129	0.347	0.339

Source: primary data, 2019 (processed)

Information: Alternative 1: Improvement of the national fish logistics system and utilization of local raw materials

Alternative 2: Increasing HR competencies related to post-production technology and handling

Alternative 3: Use high protein fish for local fish meal

Alternative 4: Assistance and facilitation related to local fish meal certification

Table 4 shows the results that the weight of the assessment of import control strategies tends to be evenly distributed. From the economic sub-sector to the resources, all choose alternative 1 as a means of controlling imports of fish meal. Meanwhile, from the infrastructure sub-sector, the strategy chosen is the fourth strategy, namely improving the logistics system, including good fish handling methods so that it does not reduce the quality of the fish sold.

3.3.4. Sub-Sector level vertical processing results. In order to achieve the main objectives, some of the sub-sectors studied are economy, policy, resources and infrastructure. Each of these subsectors has a different weight value as shown in Table 5.

Table 5. Processing weight criteria or subsectors.

No.	Subsector	Weight Value	Priority
1.	Economy	0.216	2
2.	Policy	0.207	3
3.	Resources	0.448	1
4.	Infrastructure	0.129	4

Inconsistency Ratio = 0,02

Source: primary data, 2019 (processed)

In Table 5, it can be seen that the difference between each criterion with the greatest weight value is in the criteria or resource sub-sector (0.448) although it does not rule out that other criteria are also no less important. Resource criteria become priority 1 for attention and follow up. This is because based on the respondent's experience, there are still not many and high-quality fish used for fish meal.

3.3.5. Result of vertical level strategy processing. Processing at the strategic level shows the level of influence of the strategy on the control strategy of fish meal imports. Following are the results of vertical processing at the strategy level can be seen in Table 6.

Table 6. Results of the strategy level vertical processing.

No.	Strategy Options	Weight Value	Priority
1.	Improvement of the national fish logistics system and utilization of local raw materials	0.352	1
2.	Increased HRD competencies related to technology and post-production handling	0.145	4
3.	Assistance and facilitation related to local fish meal certification	0.234	3
4.	The use of high protein fish for local fish meal	0.269	2

Inconsistency Ratio = 0.03

Source: primary data, 2019 (processed)

Table 6 shows that strategies that can be taken to control fish meal imports are improving the national fish logistics system and the use of local raw materials (0.352), using high protein fish for local fish meal (0.269), assistance and facilitation related to local fish meal certification (0.234).) and increasing the competence of human resources related to technology and post-production handling (0.145).

4. Discussion on import control strategies for fish meal commodities

Based on the results of data processing using the analysis hierarchy process (AHP) research method, the results are in the form of sub-sectors that must be a priority to be considered and followed up. The results of the analysis also produce a choice of strategies that can be applied by policy makers or the government and users or business actors, both fish meal producers and fish feed producers. The resource sub-sector is a top priority that must be immediately followed up on the problem and quickly found a solution. Resources in this matter include fish resources and human resources.

Based on survey results and field observations, there are at least three main reasons for feed producers importing fish meal. First, the volume / amount of domestic fish meal production is still low. In order to control imports, it is necessary to take strategic steps to increase local fish meal production. The results of the analysis show that the goal of increasing production is achieved through two alternative strategies, namely the improvement of the national fish logistics system and the use of local raw materials as raw material for fish meal. The improvement of national fish logistics system is expected to be able to provide fish stocks as raw material for fish meal continuously. On the other hand, the utilization of local raw materials that are in the vicinity of the business flour business actors is expected to be able to meet the need for non-manufactured alternative feeds so that production efficiency increases.

The second main reason for imports is the need for fish meal with high protein as a feed formulation that is difficult to find in locally produced fish meal. The cause of the scarcity is because so far the fish used as fish meal are the remains of fish body parts that are not used by processing businesses, such as bones, skin and fish heads. As a result, local fish meal production is of below average quality of protein requirements. This condition makes feed producers prefer imported fish meal which has a higher and complete protein content, especially as raw material for sea fish and shrimp meal.

The selection of alternative strategies for controlling imports of fish meal to address the need for fish meal with high protein is proposed consisting of two alternatives, namely 1) increasing the competence of human resources related to technology and post-production handling; and 2) the use of high protein fish as an ingredient in fish meal. Technical steps that can be taken are increasing the competence and awareness of the main fishing actors related to handling according to quality standards to obtain high quality fish. The next technical step is for the government to collaborate with the private sector to initiate a medium-scale fish meal production business using fish raw materials that are caught or directly cultivated. This means that the raw material used is no longer the leftover fish that has been done so far. Through this collaboration, all parties are involved, from cultivators and fishermen, collectors to processing factories, from initial handling to processing. Standards for fishery business activities that are applied are the same as processing standards for export commodities. This step is expected to maintain the quality of the fish used for fish meal so that the protein in the local fish meal produced is high.

The third main reason is the need for certified fish meal as an instrument of quality assurance. The need for certified fish meal is primarily needed to produce shrimp feed because shrimp is one of the export commodities. It is acknowledged that none of the local fish flour has the requested certificate, on the other hand, imported fish meal has pocketed the certificate. This condition makes national fish feed industry players have no other choice but to import certified fish meal.

This problem can be overcome through an alternative strategy of mentoring and facilitation of issuing quality certificates for local fishmeal. Technical steps that can be taken to accommodate the

needs of shrimp feed producers related to this certification are that the government has started to initiate certification assistance for fish meal producers by applying the quality standards required in the issuance of quality certificates. For domestic consumption of fish feed needs, the government can increase independent feed businesses that use local raw materials so as to reduce the amount of imported feed raw materials.

5. Conclusions and policy recommendations

The dependence of fish feed industry players on imported fish meal is still high (68%) due to the low production of local fish meal to cover the unmet need for local fish meal resulting in a deficit (shortage) of 160,390 tonnes in 2018. Fishbone analysis results show that flour imports Indonesian fish is driven by internal and external factors which are identified as four main driving factors, namely the lack of local flour production, low local high protein flour, export barriers, and available resources. AHP analysis results provide three strategies in controlling fish meal imports in Indonesia, namely: 1) increasing local fish meal production; 2) using specially caught fish as raw material for fish meal; and 3) assistance and facilitation of the issuance of quality certificates for local fishmeal.

Based on the research results, the recommended policy recommendations are: 1) the government improves the national fish logistics system to maintain the continuity of the availability of industrial raw materials; 2) the government cooperates with the private sector to initiate a medium scale fish meal production business using fresh fish raw materials; and 3) the government initiates certification assistance for the fish meal industry by applying the quality standards required in the issuance of quality certificates.

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