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STATUS AND STRATEGY OF SEMI-DRIEDANCHOVY INDUSTRY SUSTAINABILITY (STOLEPHORUS SPP.) ON EXPORT SCALE: A CASE STUDY IN REMBANG REGENCY, INDONESIA

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ABSTRACT
This study aimed to analyze the semi-dried anchovy industry sustainability in Rembang Regency based on raw material resources and ecology, economics, socio-culture, institutional law, infrastructure technology, as well as product safety and quality dimensions. The research result aimed to improve the semi-dried anchovy industry sustainability. The research aimed to provide suggestion for the Government of Rembang Regency in improving the level of sustainability. The data used in this study were primary data and secondary data obtained through literature studies, expert/stakeholder discussions, interviews, questionnaires, and field surveys. RAPFISH sustainability analysis (Rapid Appraisal for Fisheries) used Multidimensional Scaling (MDS): Leverage and Monte Carlo, and Pareto analysis. Research result the infrastructure technology (70.56%), product safety quality (61.69%), institutional law (56.47%), economy (54.14%), and socio-cultural (51.72%) dimensions of semi-dried anchovy industry in Rembang Regency were in “adequately sustainable” category. However, theraw material resources and ecologydimension (48.77%) is in “less sustainable category”. The researcher obtained 23 key leverage attributes to improve the sustainability of the semi-dried anchovy industry.

KEY WORDS
Attributes, anchovy, Rapfish, sustainability

Anchovy (*Stolephorus* spp) is a small pelagic fish that lives in groups within shallow water. It has high economic value and is abundantly available. The number of potential resources available increases the fishing rate and semi-dried anchovy processing industry development. The semi-dried anchovy is processed fishery products. It uses fresh whole anchovy raw materials. The materials are treated in boiling in salt water and dried afterward (National Standardization Agency, 2013). Within the 1990 – 2000 period, the semi-dried anchovy processing industry has become one of the “prima donnas” of Indonesian export. This is in accordance with government policy to prioritize the commodities types with good export prospects, as these industries increase employment and added value for fishery products (Ministry of Maritime Affairs, 2015). The export volume in 1996 reached 20.5 thousand tons. However, the export volume tends to decline since 1996 (Bambang, et al. 2011).

Kaliori and Sluke districts in Rembang Regency, Indonesia, are one of the areas in Central Java possessing the potential of a semi-dry anchovy industry for the export market. However, starting in 2003, many industries in Rembang Regency ceased operation. There are currently a few industries that survive. Based on Central Java Fish Quarantine and Quality Testing Center (BKIPM) data in 2017, Central Java's anchovy export capacity was182.59 tons due to declining anchovy raw materials. Anchovy commodity fluctuations were very drastic due to natural conditions. These species are sensitive to marine climate variability, temperature, aquatic elements and migratory nature properties (Checkley et al, 2009, Polovina et al, 2005, Alheit et al, 2004).

Existing conditions indicate that the semi-dried anchovy industry struggles with the sustainability of raw material resources. According to Robert et al (2005), the availability of sufficient and sustainable raw materials is one of the important factors for the sustainability of capture fisheries-based agro-industries. In addition, social, economic and government

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policies greatly influence sustainabilityas it is a complex concept. Therefore good management is needed (Milena, 2012, Alistair, et al, 2018). This is supported by Shiffman and Hueter (2017) stating that sustainability based fishery management is preferred to achieve sustainability.

Sustainability is the key to fisheries development. It is expected to improve the condition of the semi-dried anchovy industry in Rembang Regency. This study aimed to identify the sustainability status of semi-dried anchovy management, analyze the sensitivity of each attribute from the six dimensions of sustainability. The dimensions were raw material resources and ecology, economics, socio-culture, institutional law, infrastructure technology, and product quality and safety. In addition, the study aimed to formulate a strategy for managing sustainable semi-dried anchovy in Rembang Regency.

METHODS OF RESEARCH

This research was conducted using the Multi-Dimensional Scaling (MDS) approach. It is a RAPFISH (Rapid Appraisal for Fisheries) program developed by Fisheries Center, University of Colombia (Kavanagh, 2001; Fauzi and Anna, 2005). MDS is an ordination technique for mapping objects in 2-dimensional space based on the distance between objects using the euclidian distance technique. After ordination, a goodness of fit is assessed, then flipped to ensure the position of the main reference point, namely bad and good is parallel to the horizontal axis. On the other hand, the upper point (up) is above the horizontal axis and the lower point (down) is below the horizontal axis. The MDS analysis resulted in sustainability indexes which values range from 0 to 100. The sustainability index values are grouped into categories, namely 0-25 (bad),> 26-50 (less),> 50-75 (adequate) and> 76-100 (well).

The MDS Rapfish analysis results prove to be more stable compared to other multivariate analysis methods, such as factor analysis and multi-attribute utility theory (Pitcher & Preikshot, 2001). The Rapfish analysis uses Monte Carlo analysis to influence attribute reliability, Leverage analysis to find out sensitive attributes, and Pareto analysis to obtain sensitive key factors.

The sampling method for raw anchovy, semi-dried anchovy products, and respondents used purposive sampling. The semi-dried anchovy product samples were taken from three industries in Rembang Regency. Fresh anchovy samples were obtained from 3 processing units originating from TPI Tanjungsari, Kragan and Pangkalan Sluke. Samples of fresh anchovy and semi-dried anchovy products were assessed in the laboratory. The number of respondents was 16 people consisting of 3 processing industries officer, 2 fishermen, 3 DKP (Marine Fisheries Service officer), 2 Cooperative and SME Industry Trade Offices officer, 1 Bappeda (Regional Planning and Development Agency) officer, 2 traders, and 3 academics. Arrangement of attributes used a Likert scale, utilizing 48 attributes.

RESULTS AND DISCUSSION

The Rapfish's analysis result on the six dimensions of the semi-dried anchovy industry sustainability in Rembang Regency is presented in Table 1.

Table 1 - Ordination Value (MDS) Dimensions of Semi Dried Anchovies Sustainability in Rembang Regency

Sustainability Dimension	Sustainability Index		Difference	Category
	MDS	Monte Carlo		
Raw material resources and Ecology	48,77	48,99	0,216	Less sustainable
Economy	54,14	53,59	0,548	Adequately sustainable
Socio-culture	51,72	52,07	0,349	Adequately sustainable
Institutional Law	56,47	56,12	0,347	Adequately sustainable
Infrastructure Technology	70,56	68,99	1,557	Adequately sustainable
Product Quality and Safety	61,69	60,78	0,903	Adequately sustainable
Average	57,22	56,76	0,465	Adequately sustainable

Source: Results of Data Processing Using Rapfish (2019).

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The Rap-Analysis obtained ecological dimensions stress value 0.145 and R^2 value 0.950. According to Kavanagh (2001), this stress value exhibits a fairly good analysis because it is below 0.25 and the chosen variables as attributes can explain 95.0%. Analysis on ten attributes of Raw Material Resource and Ecology dimension an index value of 48.77%. It indicates the raw material ecology and resources for the semi-dried anchovy industry in Rembang is in a "less sustainable" status. The anchovy raw material resources are limited or less supportive of the ongoing semi-dried anchovy industry due to a less sustainable ecosystem. To increase the index value ecological sustainability status and raw material resources, leverage analysis was conducted. Leverage analysis is an approach to determine attributes possessing a high level of sensitivity. Leverage analysis on each ecological dimension attribute and raw material resources results in a high Root Mean Square (RMS) value and is a sensitive attribute that must be intervened or corrected.

Furthermore, Pareto analysis of each attribute RMS determines the sensitive key factor. This is in accordance with Lind et al (2014), which emphasizes most "activities" in a process caused by relatively few "factors".

The Pareto analysis result on the raw material resources and ecology dimension indicate that there are 3 sensitive key attributes affecting sustainability status: (1) the level of competition in obtaining raw materials, (2) raw materials quality fluctuations, and (3) types of fishing gear. Based on the analysis result, the value of the ecological dimension is low. Based on DKP Rembang anchovy production (2018) data over a period of 5 years, there was a decrease in anchovy production. It exhibited a declining total production from 2,376 tons in 2013 to 1,951.32 tons in 2017. The anchovy raw material is very dependent on natural conditions. It is currently difficult to predict. According to Aditya, et al. (2016) the distribution of anchovy catches is influenced by Sea Surface Temperature (SPL), chlorophyll-a, salinity, and rainfall. This limitation of raw materials causes high competition in obtaining raw materials. Due to this limitation, semi-dried anchovy producers procure raw materials from outside Rembang, namely from several districts/cities in Central and East Java. This distance causes potential raw materials quality fluctuations. In addition, fishermen and suppliers usage of ice on anchovy catches is not adequate. The limitation of raw materials is influenced by the type of fishing gear used by fishermen in Rembang Regency which only fulfills two conditions, namely cheap investment costs and economically profitable. However, the fishing gears used are classified as prohibited by the government. Rembang Regency fishermen uses *Dogol* and *Payang* (large nets). Based on the Republic of Indonesia Minister of Maritime Affairs and Fisheries Regulation Number 2 / PERMEN-KP / 2015, the fishing gear is included in the category of trawler fishing and therefore is prohibited. This type of fishing gear may decline fish resources and threaten the preservation of the fish resources environment. Therefore, it is necessary to implement government regulations and supervision.

Rap-Analysis results obtained Economic dimension stress value 0.132 and R^2 value 0.953. According to Kavanagh (2001), this stress value exhibits a fairly good analysis result because it is below 0.25 and the chosen variables as attributes can explain 95.3%. Analysis on 10 attributes of the economic dimension obtained 54.14% index value. It indicates that semi-dry anchovy industry economy in Rembang Regency is in an "adequately sustainable" status.

Based on the results of the Leverage analysis, the sensitive attributes affecting the economic dimension were obtained. The Pareto analysis was conducted to obtain sensitive key attributes. Pareto analysis of economic dimensions exhibited 3 sensitive attributes, namely (1) the contribution of fisheries to GRDP, (2) profit transfer, and (3) raw material prices. The 2017 business highest GDP contributors are agriculture, forestry and fisheries sector at 27.15%. However, the fisheries sub-sector only contributed 5.78% (based on current prices) and 5.61% (on the basis of constant 2010 prices). This is not directly proportional to Rembang regency which has a coastal area of 355.95 km^2. Rembang Regency possesses 35% coastal area out of 1,014 km^2 (Bappeda of Rembang Regency, 2018). The Rembang Regency household generally conducts agriculture as opposed to fisheries.

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The small fisheries contribution to Rembang GDP is influenced by profit transfer. Almost 30% of the fishing crew was not Rembang natives. There are several fishing vessels owned by non-Rembang resident.Therefore the catch was mostly brought out of Rembang. This condition decreases Rembang fishery subsector. It is similar Hermawan, et al. (2012) research result exhibiting the economy of the area around the ZEE waters of the South Indian Ocean East Java runs slowly as the products are mostly taken out of Malang (capital outflow). The raw material price is aleverage attribute in the economic dimension. High raw material prices deter business actors from procuring raw materials. Therefore the semi-dried anchovy industry closes or uses cheaper fish.

Rap-Analysis results obtained the socio-culture dimension stress value 0.133 and R^2 value 0.950. This analysis exhibits fairly good results because stress values are below 0.25. The chosen variables attributes can explain 95.0%. Analysis on 8 attributes of the socio-cultural dimension obtained an index value 51.72%. It indicated that semi-dried anchovy industry socio-culture dimension in Rembang Regency was in an "adequately sustainable" status.

Based on the results of the leverage analysis and Pareto analysis, it obtained 5 sensitive attributes as key factors affecting the sustainability of the socio-cultural dimension. The leverage attributes consist of (1) processing industry age, (2) community access to product, (3) concentration of processing business, (4) family participation, (5) frequency of social conflict. This indicates that it is necessary to maintain positive attributes and suppress negative attributes affecting the socio-cultural dimension in optimizing the management of the semi-dry anchovy industry.

The Rap-Analysis obtained institutional law stress value 0.140 and R^2 value 0.950. According to Kavanagh (2001), this stress value exhibits a fairly good analysis result because it is below 0.25. The chosen variables as attributes can explain 95.0%. Analysis on 6 attributes of the institutional law dimension obtained an index value 56.47%. It indicates that semi-dried anchovy industry institutional law dimension in Rembang Regency was in an ''adequately sustainable'' status.

Based on the results of leverage analysis and Pareto analysis, there were 3 sensitive attributes key factors affecting the sustainability of institutional law dimensions: (1) the availability of formal and informal regulations, (2) the existence and role of community leaders, (3) the role of local / informal institutions which supports the fishery products processing. The availability semi-dried anchovy industry formal and informal regulations in Rembang Regency are numerous. The regulations on wastewater quality standards (LH PERMEN No. 5 2014), employee wage regulations (RI PERMEN No. 78 of 2015), business permits (RI PERMEN No. 107 2015), etc. Institutional law management requires continued existing regulations supervision. The community leaders in Rembang Regency has a little role, exhibited by the behavior of the surrounding community forgoing waste processing. Therefore, seawater purity is not well maintained. Local/informal institutions supporting fish products processing in Rembang are more dominant compared to formal institutions. Informal institutions lack a role, as there are no customary institutions such as *Panglima Laot* (Coastal Villages Customary Institution) in Aceh. Usually, informal institutions are established due to problems that cannot be addressed individually. Currently, the processing of anchovy products could be conducted smoothly by each industry.

Rap-Analysis results obtained infrastructure technologydimension stress value 0.135 and R^2 value 0.952. According to Kavanagh (2001), stress value exhibits a fairly good analysis result because it is below 0.25. The chosen variables as attributes can explain as much as 95.2%. Analysis on 8 attributes of the technological infrastructure dimension obtained the index value 70.56%. It indicates that infrastructure technology dimension of the semi-dry anchovy industry in Rembang is in an ''adequately sustainable'' status.

Despite infrastructure technology being adequately sustainable, there are 5 sensitive attributes influencing the level of sustainability: (1) infrastructure facility support, (2) availability and ease of obtaining ice, (3) availability of clean water, (4) availability of electricity, (5) availability of supporting materials. Infrastructure facility support is a sensitive key attribute as it illustrates simple infrastructure facilities of the semi-dried anchovy industry

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in Rembang Regency. In order to simplify the processing and maintain product quality, it is necessary to use sizing grading machine and design layout processes. The production process needs to be improved to prevent cross-contamination. The availability and ease of obtaining ice and clean water in the industry have been met and is sufficient. However, fishermen and suppliers lack the availability and means of obtaining ice. The availability of electricity in the semi-dried anchovy industry in Rembang Regency is sufficient. However, one out of three industries does not possess a backup power source to be used in the event of a blackout. The availability of supporting materials in the semi-dry anchovy industry is sufficient. However, two out of three industries do not package finished products. Instead, the industries send the finished products to larger industries.

Rap-Analysis results in exhibit product quality and safety stress value 0.135 and R^2 value 0.950. The stress value exhibits a fairly good analysis result because it is still below 0.25. The chosen variables attributes can explain as much as 95.0%. Analysis on 6 attributes of product quality and safety dimensions obtained index value 61.69%. It indicates the product quality and safety dimension of the semi-dried anchovy industry in Rembang Regency was in an "adequately sustainable" status.

Based on the results of the leverage analysis and Pareto analysis, 4 sensitive attributes affecting the level of sustainability are as follows: (1) the application of GMP SSOP, (2) preservatives (Formaline), (3) salinity, (4) microbial contamination. The application of GMP SSOP is the most sensitive attribute because only one out of three industries possess SSOP GMP manual. However, its application is not maximal. Whereas the GMP SSOP in the processing of semi-dried anchovy determines the quality of the product (Amin et al. 2018).

Formaline and harmful additives affect traditional raw materials and processed fish products. In fact, dangerous additives can cause dangerous diseases (Irawan, 2016). Formalin is prohibited in the Regulation of the Minister of Health No. 033 2012. Formaldehyde and bleach test in the semi-dried anchovy industry has negative results. This needs to be monitoredto ensure there is no fraud at the fishermen or processing industry level. In turn, to deter consumers or industry harm. The salt content of semi-dried anchovy products from the three industries is 5.18% to 6.6%. This meets the standards of SNI 3461.1: 2013. Microbial contaminants of anchovy raw materials meet SNI 2729: 2013 standards which are below $5.0x10^5$. Microbial contamination in semi-dried anchovy products also meets the standards of SNI 3461.1: 2013 which is below $1x10^5$.

Improvements to sensitive attributes mainly affect the value of the sustainability index of the raw materials resource and ecology dimensions. It needs to be improved to ensure indexes valuecontinue to increase from “adequately sustainable” to “sustainable" status. The limitation index value for the Rapfish analysis on semi-dried anchovy industry sustainability in Rembang Regency is presented in Figure 1.

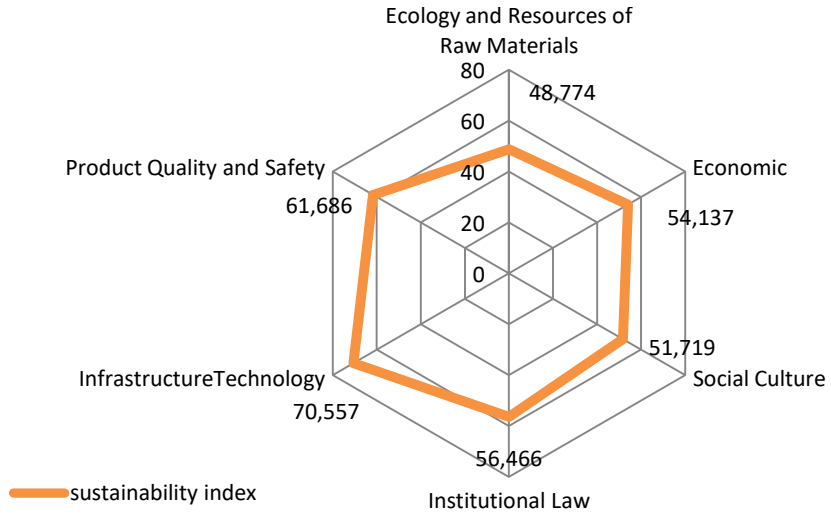

Figure 1 – The Hexagonal Kite Diagram of the Semi-Dried Anchovy Industry Sustainability Index

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in Rembang Regency

Figure 1 exhibits the inter-dimension relationship on the semi-dried anchovy industry management in Rembang Regency. The economic, socio-cultural, institutional law, infrastructure, product quality, and safety dimensions are adequately sustainable. However, there is no positive influence on the raw material resources and ecology dimension. The availability of formal and informal regulations, as well as existing institutions, has not been fully implemented. For example, a lack of government supervision on monitoring prohibited fishing gear. Despite artificial coral reefs were planted as an effort to maintain the marine ecosystem and environment, there is a lack of continuous supervision as a follow-up. In addition, there is also a lack of social awareness in safeguarding and preserving aquatic resources. Therefore it requires the community to possess a broader view on fisheries sustainability and the government to implement sustainable policies (UNESCO, 2017).

Based on the results of Rap-TNSK analysis on the 48 attributes of the 6 sustainability dimensions, 23 sensitive attributes were obtained as leverage attributes. The greater the RMS value changes due to the loss of an attribute or indicator, the greater the role of these attributes in the formation of a sustainability index (Kavanagh and Pitcher, 2004). The leverage attribute on the sustainability of the semi-dried anchovy industry in Rembang Regency is presented in Table 2.

Table 2 – Six Dimensional Leverage Factors of Sustainability

Dimension		Leverage Factor	Root Mean Square (RMS)
Raw material resources Ecology	1	Competition Level in Obtaining Resources	3,570
	2	Resources Quality Fluctuation	3,532
	3	Fishing Gear Type	1,273
Socio-Culture	4	Processing Business Age	6,933
	5	Community Access to Product	5,793
	6	Processing Business Access	4,971
	7	Family Participation	4,889
	8	Social Conflict Frequency	4,290
Economy	9	Fishery Contribution to GDP	4,976
	10	Profit Transfer	4,555
	11	Raw Material Cost	3,120
Institutional Law	12	Formal and Informal Regulation	6,38
	13	Community Leaders Existence and Role	4,98
	14	The Role of Local / Informal Institution Supporting the Processing of Fishery Products	3,97
Product Quality and Safety	15	GMP SSOP Implementation	7,477
	16	Preservatives	7,042
	17	Salt Content	7,008
	18	Microbial Contamination	6,311
Infrastructure Technology	19	Infrastructure Support	6,487
	20	Availability and Ease of Obtaining Ice	4,607
	21	Availability of Clean Water	4,433
	22	Availability of Electricity	4,181
	23	Availability of Supporting Material	3,916

Source: Rapfish Data Processing Result (2019).

The development of a sustainable strategy for managing the semi-dried anchovy industry is done by looking at the interactions between the raw material resources ecology, economics, socio-culture, institutional law, infrastructure technology, as well as product quality and safety. The strategy is based on an integrated approach to all sensitive attributes affecting sustainability. Management efforts conducted are current performance improvement and increasing sensitive attribute values.

The formulation of strategies to increase index value is described as follows: (1) increasing raw material resources, which are carried out by synergic supervision between provincial and regional governments; (2) Increasing socio-culture dimension through upgrading human resources, increasing community access to product, and managing social conflict; (3) increasing economic dimension by increasing the number of processing

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industries; (4) improvement of legal and institutional capacity; (5) quality improvement and product differentiation; and (6) facility and infrastructure improvements.

CONCLUSION

The analysis result on the sustainability of the semi-dried anchovy industry in Rembang Regency six dimensions were 57.223% in "adequately sustainable" category. The primary improvement is raw material resources ecology dimension, as it greatly determines the sustainability of the semi-dried anchovy industry in Rembang Regency. To improve the leverage factor, community cooperation and synergic role between regional and provincial governments are needed.

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