Sustainability Issues of the Coconut Supply Chain in Indonesia

by Ig Jaka Mulyono

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Abstract - **Coconut is one of Indonesia's strategic agricultural commodities. However, in the past five years, many issues on the sustainability of the coconut supply chain in Indonesia have been revealed in the mass media. This study aims to explore the issue by exploring discussions that emerge in online news articles. It employs content analysis and binary factor analysis to investigate and construct the information in identifying and narrating the issue of sustainability of the coconut supply chain in Indonesia. The result shows that the sustainability of the coconut supply chain in Indonesia experiences disruptions and requires an immediate long-term strategy for restoration. This will provide insight into the real condition of the coconut supply chain in Indonesia so that could become the basis for further research. Future work should include a simulation study to find the best policy in maintaining the sustainability of the coconut supply chain in Indonesia.**

Keywords - **Coconuts, mass media, supply chain, sustainability**

I. INTRODUCTION

The global value of coconut commodities is reflected in two production countries: Indonesia and the Philippines. These two countries are often compared to each other and numerously exchange positions as the world's number one coconuts' exporter country. In 2016, Indonesia has the largest coconut plantation areas in the world covering 3.65 million ha, followed by the Philippines with 3.57 million ha of coconut plantation [1, 2]. In the past few years, the coconut plantation area in Indonesia was observed at a generally decreasing trend. In contrast, the total area of coconut plantations in the Philippines has consistently increased. In 2017, Indonesia lost its position to the Philippines as the country with the largest total area of coconut plantations in the world. This is a concerning situation, considering Indonesia is a country with a 99 thousand km coastline, which provides the ideal condition for coconuts trees. As a comparison, the Philippines only has a coastline of 36 thousand kilometers. Looking at the gradual decrease of the coconut plantation area indicates a shift in commitment to maintaining Indonesia's position as a major player in the world supply of coconut commodities.

Coconut is one of the leading agricultural commodities in Indonesia. Geographically, Indonesia has the best climate for coconuts palm to grow and survive well. However, the coconut yield in Indonesia has been only in the range of 1.1 tons/ha/year equivalent to copra in the last five years [3]. The yield that less than 2 tons/ha/year of copra equivalent is still considered at low productivity so that the crops have not been able to provide an optimal economic contribution for the welfare of coconut farmers in Indonesia.

The issues of the coconut supply chain in Indonesia more or less would affect its sustainability. From the economic perspective, coconut is one of the Indonesian strategic commodities in the agriculture sector because of its high export potential. Nevertheless, coconut commodity is the potential to improve the rural economy. Coconut is the main source of income for about 6.6 million farmers in Indonesia [4]. Besides, many other players in the supply chain also depend on coconut by taking on the roles of collectors, small traders, wholesalers, brokers, processors, and retailers [5]. In its value chain, coconut is not only processed into food products but also other products such as chemicals and various materials for automotive industries. Moreover, the coconut processing industry provides various employment for Indonesian people. Besides its economic and social values, the coconut tree and its husks can be used as natural protection from abrasion and erosion on the beach. These excessive environmental, social, and economic impacts point out the importance of the coconut commodity and its supply chain in Indonesia.

The mass media is one source of literature that can be used as a reference to obtain information on current issues. In terms of information quality, mass media is better than social media because of the legality in the news spread. In the past, newspapers are the most reliable media to get daily information. Due to the development of mass media technology, its role has been gradually replaced by online news. In Indonesia, the credibility of online news is getting better, since it is supervised by the Ministry of Information and Communication. The news media serves the public by providing the latest information on issues from various perspectives. This can help to provide a better understanding of the problem. Thus, this research is an exploratory study that employs online news as a reference to identify problems in the coconut supply chain in Indonesia.

Until now, only a small number of research in the field of the supply chain have used the news as a data source. This approach has been applied to explore cases of Salmonella bacterial contamination in eggs in Iowa [6]. News articles have also been used in some exploratory studies, including a study on trends in sustainable supply chain management [7] and a study on panic buying that can disrupt the supply chain [8]. Other research used news articles to evaluate global suppliers in increasing supply chain resilience [9]. Based on these previous studies, the use of news as a source of research data has proven to provide impactful findings on the topics raised.

Alongside the declining interest in coconut commodities in Indonesia, research related to coconut commodities in Indonesia has become less attractive. Only a few scientific articles discuss the study of coconut commodities. Novarianto and Warokka [10] conducted a study on the development of research on coconut in Indonesia and found the urgency of research related to how to increase productivity. Kambey et al. [11] identified the influential factors on Indonesian coconut export performance. Heriyanto [12] presented the competitiveness of Indonesian coconuts in the international market and found that Indonesian coconuts had slightly better competitiveness than the Philippines based on the Trade Specialization Index. Alouw and Wulandari [4] conducted a study related to the condition of coconut commodities in Indonesia and concluded that the sustainability of coconut commodities in Indonesia is under threat. Nevertheless, to the best of our knowledge, research that specifically addresses the issues faced by the coconut supply chain in Indonesia has never been found in the previous literature. This study fills the gap and employs content analysis as the method to extract information from online news. The results of which are analyzed using binary factor analysis. The main objective of this study is to evaluate the current sustainability condition of the coconut supply chain in Indonesia as well as to provide insight and direction for further research on the coconut supply chain policy in Indonesia.

II. METHODOLOGY

A. Data collection

The data sample searching process was carried out for about two weeks on May 2021 using the Google search engine with keywords "Kelapa Indonesia" and "Industri Kelapa Indonesia". The number of samples is set at 100 online news articles (quota sampling). The inclusion criteria in this study are news articles or opinions from trusted sites such as national news portals, official government websites, or NGO sites; written in the Indonesian language; and was published between 2015 to 2021. Meanwhile, the exclusion criteria are news originating from social media and scientific articles. The reason is that news originating from social media does not meet the rules of journalism and is considered biased. Likewise, scientific articles are also excluded because this study aims to capture the results of primary observations reported in the mass media. The list of online news used in this study is not displayed due to page limitations, if needed can be provided by request.

B. Data analysis

This research employs two data analysis instruments, which are the content analysis and the binary factor analysis. The content analysis seeks to obtain complete information from each sample. A preliminary content analysis of 25 online news articles was carried out to find codes. It is done by investigating topics that often appear in the news articles line-by-line. After establishing the

code, the same analysis of 100 data samples was carried out including 25 articles used in preliminary analysis. The code is traced in a spreadsheet and would be used as variables for the factor analysis.

The second part of the analysis is performing Exploratory Factor Analysis (EFA) for binary data. The main purpose is to reduce the number of variables and look for joint variation in response to unobserved latent variables [10]. EFA is used because the state of this research is still in its infancy, and we have yet to identify strongly theorized causal relationships between variables. To perform binary factor analysis, it is necessary to modify the binary data by computing its tetrachoric correlations. These correlations are used as input to EFA, which reflects the correlations between the underlying variables that are assumed continuous. For this purpose, the Factor Analysis using the minimum residuals method is applied in R software.

III. RESULTS

A. Data sampling description

The distribution of news sample data by year of publication shows that 33% of the online news articles were published in 2020, followed by 26% published in 2019, 18% published in 2018, 11% published in 2017, 8% published in 2021, 3% published in 2016, and only 1% published in 2015. However, one should restrain from concluding that this distribution represents the trend of an increasing number of news about coconut commodities in Indonesia. The reason is that some online news portals delete their news articles after a certain period of publication. Thus, the majority of the news article available is published in the latest year.

Based on the preliminary study, 14 codes were obtained as shown in Table 1.

TABLE I
CODES FOR CONTENT ANALYSIS

Code	Symbol	Code	Symbol
Coconut production and productivity	x1	Coconut Processing Industry	x8
Domestic coconut trade	x2	Product Quality	x9
Fresh coconut export	x3	Coconut-derived food product	x10
Domestic value-added	x4	Coconut-derived non-food product	x11
Export of coconut processed products	x5	Coconut Oil	x12
The Substitution of coconut oil	x6	Coconut Farmers	x13
Domestic demand	x7	The impact of fresh coconut export	x14

These codes were used to identify the discussion topics that occurred in the sample dataset. During this process, it is possible to add codes. However, if the additional codes do not exist in other online news samples then the code is considered insignificant and is eliminated. The binary numbers are used to show the presence of codes in each

article. If a keyword that refers to a predetermined code is found, then the spreadsheet is assigned a number 1 and otherwise is 0. The accumulation of this process is summarized and shown in Fig. 1.

Two codes appear most frequently, which are x1-coconut production and productivity and x8-coconut processing industry. It is followed by x5-export of coconut processed products, x10-coconut processed food products, and x13-coconut farmers.
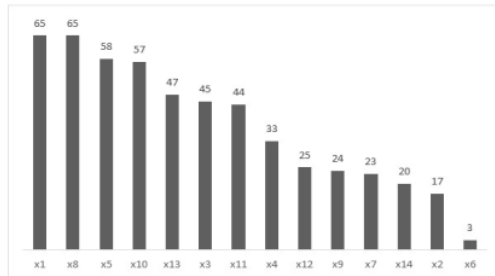

Fig. 1. The number of codes appears in 100 online news sample articles

B. The Binary Factor Analysis

One of the techniques to modify binary data into tetrachoric correlations is by recoding the data as a factor and computing its appropriate heterogeneous correlation based on the type of variables [14]. By far, four factors seem to be reasonable. Fig. 2 presents the scree plot of eigenvalues, where the plot flattens out after the fourth eigenvalue. It also shows a comparison with the scree of a random data matrix of the same size marked in a dashed line, which confirms the choice of four factors.
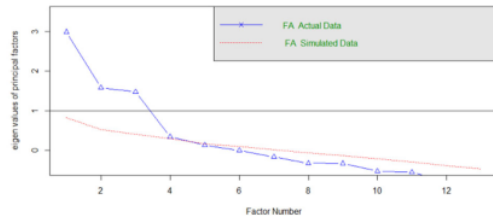

Fig. 2. The Scree Plot of Eigenvalue

By applying the varimax rotation and minimum residual methods, the results of the binary factor analysis with four factors are displayed in Table 2. Firstly, we need to ensure the adequacy of factors to validate the model. Table 2 shows that the SS loading of the four factors suggested is greater than 1, which indicates that the factors are worth keeping based on Kaiser's rule. The root means square of residuals (RMSR) is 0.07. This is acceptable as this value should be closer to 0. In addition, the results also show the hypothesis of the four factors is sufficient with the fit based upon the diagonal values is 95%.

The four factors suggested by the analysis distributes the variables into four categories. The grouping is performed based on the highest loading for each variable.

If there is a variable with the same loading value, the grouping will follow the suggestion by R software. This research mainly considers the variables with the loading value of 0.32 and above. This is a cut-off level recommended in the literature because a loading below 0.32 suggests an overlap of 10% or more in variance among the factors [15].

TABLE II
RESULT OF FACTOR ANALYSIS

Symbol	MR1	MR2	MR3	MR4	h2	u2	com
x4	0.64				0.43	0.57	1.1
x6	0.96				1.06	-0.06	1.3
x10	0.77				0.67	0.33	1.3
x12	0.84				0.78	0.22	1.2
x3		0.79			0.77	0.23	1.5
x14		0.98			1.03	-0.03	1.2
x1			0.48		0.27	0.73	1.3
x2			0.69		0.61	0.39	1.6
x5			-0.70		0.52	0.48	1.1
x11	0.37		-0.47		0.40	0.60	2.4
x13	0.44		0.44		0.41	0.59	2.3
x7				0.99	1.02	-0.02	1.1
x8			0.32		0.38	0.30	0.70	2.7
x9		-0.37			0.38	0.30	0.70	2.3
	MR1	MR2	MR3	MR4			
SS Loading	3.11	2.07	1.95	1.45			
Proportion Explained	0.36	0.24	0.23	0.17			

Mean item complexity = 1.6
Test of the hypothesis that 4 factors are sufficient.
The root mean square of the residuals (RMSR) is 0.07
RMSEA index = 0.835 and The 90 % confidence intervals is 0.865
Fit based upon off-diagonal values = 0.95

The MR1 factor can be interpreted as capturing the information about the various coconut food chain in Indonesia. Mainly it consists of coconut food products, such as coconut powder, coconut milk, and coconut oil, etc. Therefore, we re-label this factor "Indonesian coconut food chain" to illustrate the importance of higher value products to strengthen the coconut supply chain.

MR2 consists of two variables, which are x3 and x14. This category captures mainly the issues of the export of fresh coconut and its impact. This category seems to signify that the practice of fresh coconut export would strongly affect the coconut supply chain. We label this category "The Fresh Coconut Export".

The MR3 category is called "Indonesia's coconut value chain". It captures the coconut industry chain, starting from the supply side (farmers), production, product, and market. Three variables with positive loading are related to supply (x13), production (x1), and domestic trading (x3), which seems to speak the main concern that would affect the coconut supply chain. It also indicates the need to optimize these three aspects to support the growth

of the coconut supply chain. It is interesting to see that the variables of the coconut-derived non-food product (x11) and export market (x5) have negatives loading. There is an indication that the practice of these variables has issues that negatively influence the coconut supply chain in general.

Lastly, one final cross-category factor (MR4) is labeled "Domestic coconut supply chain". The three variables included are domestic demand, the coconut processing industry, and product quality. The variable of domestic demand records the highest loading compared to other variables. This indicates that it is the main driver in improving the sustainability of the coconut supply chain. These four categories are then used as themes to discuss the issue of sustainability in the coconut supply chain in Indonesia.

IV. DISCUSSION

A. Indonesian coconut food chain

Based on market demand, the coconut value chain is divided into three strands: (1) coconut food chain, (2) coconut sports drink chain, and (3) coconut chemical chain [16]. Originally, coconut sports drink was part of the coconut food chain, but because it is a new market that is growing rapidly, the coconut sports drink is considered a separate chain strand. The coconut food chain includes Refine Bleached Deodorize Coconut Oil (RBDCNO) also known as coconut cooking oil, Virgin Coconut Oil (VCO), desiccated coconut, coconut sugar, coconut milk, and cream. Compared to other coconut-derived food products, RBDCNO is the product with the largest export market share. There are 38 RBDCNO producers in Indonesia, spread across the country. The majority of RBDCNO factories are located on the island of Java because of the proximity to the main market and also to the international port.

Although RBDCNO is the most popular product among other coconut-derived food products, its domestic consumption tends to decline. The main issue found is that the difficulty in obtaining copra (raw material) which makes industry are unable to produce at an economic scale. Furthermore, the market share is far lower than palm oil; the most produced and consumed cooking oil in Indonesia. One of the possible reasons is that these two products used similar terminology. In the Indonesian language, coconut oil is called "Minyak Kelapa", while palm oil is called "Minyak Kelapa Sawit". The similarity of these two terms gives an impression to the consumers that they are indifferent. In addition, health issues related to the consumption of coconut oil that was not proven in the 1970s diverted most consumers of coconut cooking oil to its substitute products. This is unfortunate because the production of RBDCNO is the longest value chain in the coconut food chain that may provide many improvement opportunities to Indonesia's economics.

B. Fresh coconut export

The export of fresh coconut is a dilemma that must be considered by the government. Similar to the export of other raw materials, the export of fresh coconut has a negative impact on the domestic value chain thus has an adverse consequence for the national economy. It could bring small fast income for few players, but damage effect for the sustainability of the coconut supply chain for a long time. Moreover, it has been argued as one of the reasons that cause the rarity of copra for supplying the domestic coconut processing industry.

Currently, local farmers and traders tend to choose to export fresh coconut due to the relatively higher selling price rather than having to carry out further domestic processing. Fresh coconut price for export is the main issue that must be resolved in balancing the fresh coconut supply for exports and meeting the needs of the domestic coconut industry. One solution is the disclosure of information in the supply chain network so that the government can take appropriate policies accordingly. As an example, give a higher tax for fresh coconut export if the fulfillment of domestic demand has not been met.

C. Indonesian coconut value chain

The major issues in the Indonesian coconut value chain are low coconut production and productivity. One of the reasons is that coconut trees in Indonesia are over-aged and no longer productive. Besides, plantation area is decreasing year by year as many farmers lost interest in coconut farming and switch to other commodities that could give income in a shorter time.

It takes 5-8 years for coconut palms to produce their first fruit, but it can be productive for about 80 years. Seeing the long life span of coconut plants, long-term planning, and strategic roadmaps are needed to increase the availability of coconuts. The portion of coconut plantations owned by the government is also very small, so developing policies based on government plantations will not produce significant results. There needs to be a long-term grand strategy that must be carried out with a strong commitment without being disturbed by political dynamics starting with the disclosure of information regarding the age of coconut trees in all plantations in Indonesia. Replantation and incentive programs could be a government top-down initiative to stimulate coconut plantation by smallholders. The incentives are necessary considering the profit from coconut plantation cannot be attained in short term.

The downstream processing industry is very important in the coconut supply chain, It provides the opportunity to produce different products, especially in non-food products such as shells made of charcoal and husk. This non-food coconut derivative product has considerable export potential. However, the selling price is often not fitting with the transportation costs. Thus, a fair policy on transportation costs is another issue that should be solved to improve the downstream processing industries. In conclusion, the government needs to establish structured and reliable policies to restore the sustainability of coconut commodities in Indonesia.

D. Domestic coconut supply chain

The coconut sector in Indonesia has a long and complex supply chain. The upstream supply chain is a commodity-focused chain and the downstream supply

chain is a consumer-driven value chain with many derivatives of coconut products, both food and non-food [17]. The coconut supply chain in Indonesia is asymmetric and mostly driven by demand from the processing industry. At the domestic level, no strong lead firms in this asymmetric supply chain that has a great influence for stimulating interest in coconut plantations. Recently, VCO products have been growing at a premium selling price and are expected to act as the lead firm. Still, until now the VCO industry has not been able to intensify the upstream industries of the coconut supply chain.

Although Indonesia's coconut supply chain has not in the best shape yet, the quality of Indonesian coconut and its derivative products is very competitive in the international market. Coconut charcoal from Indonesia is known as one of the best in the world. This is because, in the commodity market, quality is an important factor in determining prices, in addition to supply and demand. Quality standards for coconut and various derivative products in Indonesia have been regulated in the Indonesian National Standard (SNI).

V. CONCLUSION

Overall, the sustainability of coconut supply chain in Indonesia is under threat. Statistics show a consistent decline in the plantation area over the last five years. The issue of coconut production and productivity is the most widely discussed in online news. The coconut processing industry, which admits that it is difficult to obtain raw materials, indicates a disruption in the coconut value chain in Indonesia. Moreover, the tendency of farmers and traders to export fresh coconut implies the need for information disclosure. Government intervention and a strong commitment to establish and implement a long-term strategy is crucial in the attempt to overcome these problems. The main research limitation lies in the content analysis methodology. It was difficult to make a general conclusion from unstructured data analysis. For further research, simulation study based on quantitative data to find effective strategies in maintaining coconut sustainability in Indonesia is required.

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