Uncertain Supply Chain Management 9 (2021) 227–236

Contents lists available at GrowingScience

Uncertain Supply Chain Management

homepage: www.GrowingScience.com/uscm

The performance improvement of sustainable palm oil supply chain management after COVID-19: Priority indicators using F-AHP

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C H R O N I C L E

Article history:
Received November 8, 2020
Received in revised format January, 28, 2021
Accepted March 24 2021
Available online March 25 2021

Keywords:
COVID-19
Palm oil
Performance
Sustainable supply chain management

A B S T R A C T

The performance of sustainable supply chain management today, especially for palm oil, continues to experience a drastic decline from the social, economic, and environmental perspectives. Both the supply and demand sides are undergoing severe disruption due to the COVID-19 pandemic. To survive the COVID-19 situation and afterward, the palm oil industry needs to focus on priority indicators for immediate improvement. For that reason, our study aims to determine the primary indicators used to assess the performance of sustainable supply chain management to improve the palm oil industry's performance immediately. The F-AHP method is used to rank which indicators are focused on the COVID-19 situation and thereafter. The findings of this study designate that there are three main indicators, namely from the economic side (adaptability), the social side (improving employee health and safety), and the environmental side (sustainable supplier management). This finding is beneficial for the industry and for supply chain actors such as suppliers, customers, and the government in taking attitudes and setting policies related to sustainable supply chain management in the face of pandemic.

1. Introduction

The COVID-19 pandemic is currently causing severe disruption to global supply chains throughout the world, causing logical and enormous consequences for the global economy, affecting all business sectors (Guan et al., 2020; Herdady & Muchtaridi, 2020; R. Sharma et al., 2020). The palm oil industry sector, especially in developing countries such as Indonesia, is also affected. In the last three years, Indonesia is recognized as the largest palm oil exporter globally, with a market share -until the end of 2019- estimated to reach 47% of global palm oil consumption needs, or around 34 million tonnes (WE, 2020). Although the performance of palm oil exports in Indonesia has declined dramatically, this industry is a savior of the national economy amidst the global uncertainty due to the pandemic because it still makes a positive contribution (Supriyatna, 2020). However, the palm oil export market must be a concern, considering that some of the export destination countries such as China, the European Union, India, Africa, and Pakistan, as the largest vegetable oil buyers in the world, have implemented restrictions on economic activity (Yuniartha, 2020). As a result of the pandemic in 2020, there has been a large decline of between 13% and 32% in international trade, disrupting economic activity (WTO, 2020). Based on this problem, the palm oil industry will severely impact a decline in sustainable supply chain management performance from the economic, social, and environmental perspectives. This decrease was due to disruption in supply chain components such as procurement, production, distribution, and logistics (Ivanov, 2020). The emergence of supply problems is also caused by demand problems, which significantly affect supply chain management and distribution systems (Gray, 2020). Stakeholders from processing, retail, and agricultural distribution suffer greatly from demand-side shocks (panic buying), shortages of supply, and transportation problems (Hailu, 2020). Companies are required to survive in fighting for long-term goals (M. Sharma et al., 2020). Sustainable supply chain management is a fundamental approach to managing the processes and activities of the palm oil industry's entire supply chain during this pandemic. Thus, sustainable

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doi: 10.5267/j.uscm.2021.3.010

supply chains must be managed in earnest by finding a series of appropriate alternative strategies to increase their resilience capabilities (Hobbs, 2020). In regards to maintaining the palm oil industry's resilience and competitiveness, a comprehensive approach is needed (Hadiguna & Tjahjono, 2017). Therefore, the recovery and improvement of company performance must pay attention to the overall economic, environmental, and social aspects. To reduce economic losses and restore supply chain performance both during COVID-19 and afterward, companies must redesign sustainable supply chain practices from the economic, social, and environmental perspectives. This change must be commanded as indicators used to assess sustainable supply chain management performance in the pre-pandemic era can no longer be used due to the very different situation. What immediately needs to be done is to reassess the indicators of sustainable supply chain performance. The palm oil industry needs to formulate the priority indicators that need to be considered in assessing sustainable supply chain management's performance. These indicators are critical as determinants in the decision-making process, in which any indicators need to be addressed immediately to improve their performance and prevent even more significant losses. Based on the earlier ideas, this study aimed to comprehensively produce the most critical indicators in assessing sustainable palm oil supply chain management practices during the pandemic and afterward. It is expected that sustainable supply chain resilience may be restored in response to the pandemic, hence improving the palm oil industry's performance.

2. Literature review

This segment presents literature that has been researched related to sustainable supply chain management in the context of COVID-19. This segment also clarifies the concept of thought in this paper that differentiates it from previous researchers.

2.1. Improvement of sustainable supply chain management due to COVID-19

In recent years, sustainable supply chain management is a relevant and well-known topic for researchers and practitioners (Brandenburg et al., 2014; Genovese et al., 2017). They have realized that sustainable supply chain management is vital for the company because it is related to the market and economy (Kobza & Schuster, 2016) and also as an essential strategy that promotes the company in achieving its goal of gaining over competitors and improving overall company performance (Sutawidjaya et al., 2021). For this reason, in sustainably managing the supply chain, companies must focus on three dimensions, namely the social, environmental, and economic dimensions (Raut et al., 2017). The COVID-19 pandemic resulted in a significant decrease in sales revenue, return on investment, companies' contribution to the gross domestic product (GDP), and the number of employees (Chowdhury et al., 2020). Consequently, the performance of the supply chain changed as a whole. Thus, supply chain strategies and practices that were pre-designed for the business environment could no longer be used in the face of this pandemic. Companies must manage a sustainable supply chain; therefore, the prolonged negative impact of COVID-19 can be immediately addressed by improving social, economic, and environmental performance.

2.2. Sustainability indicators for assessing the performance of supply chains

In previous research, variations in sustainability indicators based on supply chain management have been determined with various objectives amid COVID-19.

Table 1
Indicators in assessing sustainable supply chain performance

No.	Author	Economic Dimension (E)						Social Dimension (S)					Environmental Dimension (N)					
		E1	E2	E3	E4	E5	E6	S1	S2	S3	S4	S5	N1	N2	N3	N4	N5	N6
1	Bag et al. (2020)		√															
2	Choi (2020)			√														
3	Craighead et al. (2020)					√												
4	de Sousa Jabbour et al. (2020)						√											
6	Zimon et al. (2020)											√						√
7	Kamble et al. (2020)	√											√		√	√		
8	Majumdar et al. (2020)						√											
9	Zimon et al. (2019)			√				√					√					
10	Emamisaleh et al. (2018)				√				√	√			√			√		
11	Govindan (2018)												√		√	√		
12	Esfahbodi et al. (2017)							√										
13	Rajeev et al. (2017)	√			√			√	√			√				√	√	
14	Sroufe (2017)							√					√					
15	Saeed and Kersten (2017)				√			√	√	√	√	√	√	√	√	√	√	√
16	Esfahbodi et al. (2016)	√																
17	Tseng et al. (2015)													√		√		
18	Grimm et al. (2014)																√	
19	Morali and Searcy (2013)	√			√												√	
20	Ageron et al. (2012)		√	√		√	√											
21	Zailani et al. (2012)	√			√	√		√					√			√		√
22	Azevedo et al. (2011)						√											
23	Baumann (2011)						√											

However, research that addresses supply chain issues comprehensively on essential indicators that are considered to improve sustainable supply chain management performance from an economic, social, and environmental perspective during the COVID-19 pandemic has not been carried out. Moreover, in palm oil in developing countries, attention to the leading sustainability indicators has not successfully implemented a sustainable supply chain (Munny et al., 2019). In doing so, this study will help the palm oil industry improve the indicators used to assess the performance of their sustainable supply chains so that they can survive the COVID-19 situation and afterward. Consequently, the companies are expected to be able to increase sustainability initiatives and improve overall sustainability performance by ensuring efficient operational and economic performance, risk management, rapid response to uncertain environments, meeting sustainability expectations, and achieving sustainability practices (Sajjad et al., 2020; Tseng et al., 2019). A total of 41 literature sources have been observed from various topics related to sustainable supply chain management in formulating several vital indicators that are considered in assessing the performance of sustainable supply chain management from economic, social, and environmental dimensions in the context of COVID-19. Table 1 presents sustainability indicators for assessing the performance of the supply chain in the context of COVID-19.

3. Material and methods

3.1. Expert View

Expert opinion is needed to finalize the preeminent indicators and sub-indicators and form a pairwise comparison matrix. Expert opinion is obtained through semi-structured interviews, group discussions, and questionnaires (Prentkovskis et al., 2018). These experts must have ideas, knowledge, and experience about sustainable supply chain management practices and understand its problems. Solangi et al. (2019) posit that a minimum of 9 to 18 experts must be involved in the decision-making process. Based on this, in this study, thirteen experts were consulted and participated in providing meaningful feedback in decision making. These experts included two researchers, two from academia, three palm oil mill managers related to sustainable supply chain management practices consisting of managers in the economic, social, and environmental sectors, two from government agencies, two from NGOs, and two from a palm oil association (GAPKI).

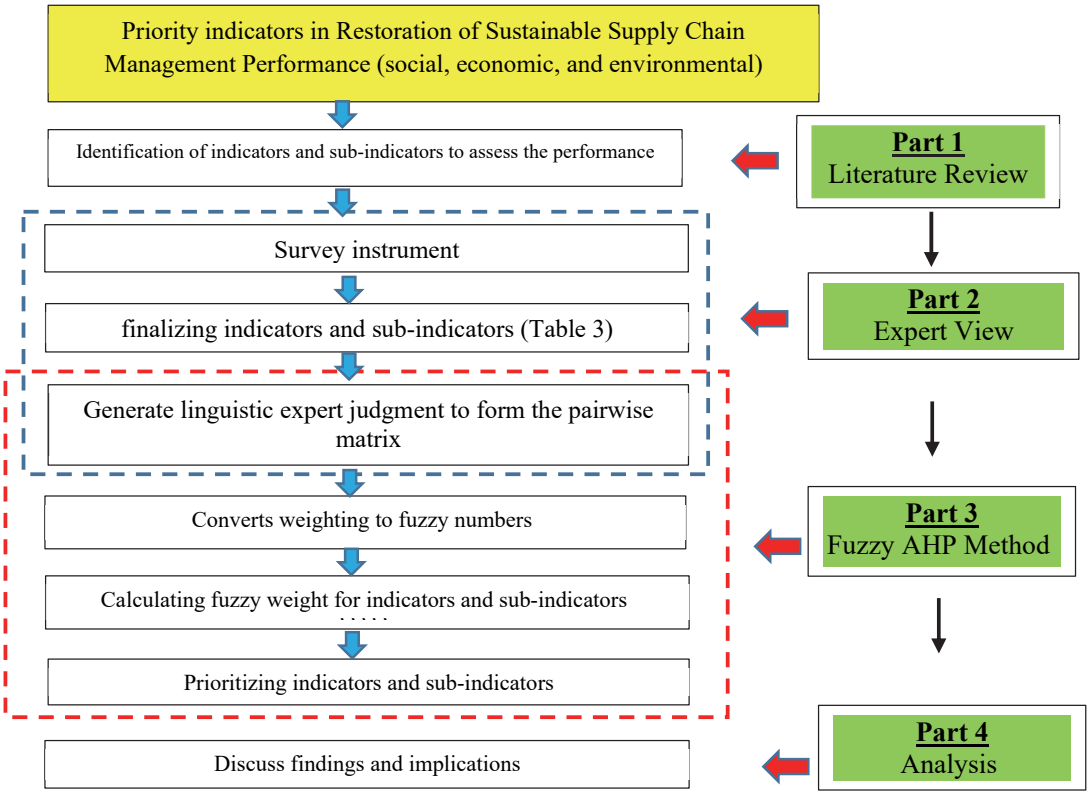

Fig. 1. Research Methodology Procedures

3.2. F-AHP Method

Fuzzy AHP is a form of MCDM that has been widely recognized and used by many researchers in making decisions and solving problems related to the implementation of sustainable supply chain management (Junior et al., 2014; Kusumawardani & Agintiara, 2015; Zhou et al., 2019). The central concept of the Fuzzy AHP Method is to generate weightings for each indicator and sub-indicator. The number of indicators is 17 for three dimensions. The economic dimension consists of 24 sub-indicators, the social dimension consists of 17 sub-indicators, and the environmental dimension consists of 16 sub-indicators. The steps of the F-AHP are as follows:

Step 1	Build a fuzzy comparison matrix for all indicators and sub-indicators using a linguistic scale. The scale used is the Triangular Fuzzy Number (TFN) from 1 to 9. (Table 2)
Step 2	Perform a consistency test. If the consistency test results meet, then the Coefficient Reliability (CR) is less than 10%
Step 3	Calculate the fuzzy weight on each indicator and sub-indicator using the Geometric Mean (Buckley, 1985). Then it will generate local weights for each indicator and global weights for each dimension
Step 4	Rank indicators from each dimension, whether economic, social, and environmental

Tabel 2
Scale Triangular Fuzzy Number (TFN)

Fuzzy Number	Variable Linguistik	TFNs
1	Equally important	(1,1,1)
3	moderately important	(2,3,4)
5	Strongly important	(4,5,6)
7	Very strongly important	(6,7,8)
9	Extremely important	(9,9,9)

Table 3
The results of the finalization of indicators and sub-indicators in assessing the performance of a sustainable supply chain

Code	Indicator	Code	Sub-indicator
Economic Dimension (E)			
E1	Environmental Costs	E11	Significant savings in operating costs
		E12	Significant savings in maintenance costs of equipment and plant facilities
		E13	Significant to purchase environmentally friendly materials
		E14	Minimizing waste disposal costs
E2.	Rapidity	E21	The period between an order by a customer and the time the order is completed
		E22	The period between the decision to purchase the goods by the customer and the time the order was received
		E23	On-time delivery
		E24	The period befalls between the decision to return the customer's goods and the time it is received back.
E3	Supply chain costs	E31	The efficiency of shipping costs
		E32	Storage cost-efficiency
		E33	The efficiency of ordering costs
E4	Market competition	E41	Significantly increase sales
		E42	Significantly increase market share
		E43	The ability to respond quickly in offering competitive products
E5.	Quality	E51	Product warranty availability (relating to defect returns, planned maintenance, and excess stock)
		E52	Significant reduction in defective and waste goods
		E53	Significant reduction in orders sent not on the schedule
E6.	Adaptability	E61	Ability to change delivery schedule plan
		E62	Ability to change unplanned orders without penalty fees
		E63	The ability to change the level of output of the resulting product
Social Dimension (S)			
S1.	Social development	S11	Significant in realizing social responsibility/concern for an entity to society and the surrounding environment
		S12	Significant increase in the number of certificates related to social development
		S13	Significantly improve relations with surrounding communities (e.g., government, private sector, NGOs.)
S2.	Health and safety	S21	Significant reduction in the number of employees injured and sick due to work.
		S22	Significant reduction in work-related deaths
		S23	Increasing the health and safety of employees
S3.	Workforce development	S31	Significantly improving the quality of employees (education and training)
		S32	Significantly increase employee satisfaction.
		S33	Significantly increase the number of pro-environmental training programs.
		S34	Significantly reduce the employee turnover rate
S4.	Human rights and anti-corruption	S41	Do not discriminate
		S42	Do not employ minors
		S43	Do not do corruption
S5	Consumer issues	S51	Fulfilling consumer needs to achieve consumer satisfaction
		S52	Significantly increase the product image
		S53	Significantly increase consumer confidence
		S54	Increase consumer interest and awareness of healthy products

Table 3
The results of the finalization of indicators and sub-indicators in assessing the performance of a sustainable supply chain

Environmental Dimension (N)			
N1	Energy efficiency	N11	Efficient use of renewable energy (sunlight, wind, rain, geothermal, and biomass)
		N12	Efficient use of non-renewable energy (kerosene, gasoline, and diesel, natural gas, and nuclear energy)
		N13	Significant savings in energy consumption (e.g., electricity)
N2	Material efficiency	N21	Significantly increases the recycling of material inputs
		N22	Significant reducing the consumption of hazardous and toxic materials
N3.	Water management	N31	Significant to recycle wastewater
		N32	Significant focus on water footprints (water quality and safety and sustainable water use)
N4	Waste and emissions management	N41	Significant reduction of wastewater production
		N42	Significant reduction in solid waste production
		N43	Significant reduction of pollution due to smoke, waste pollution, hazardous materials, and others
N5	Sustainable supplier management	N51	The existence of ethical standards from suppliers, including environmental sustainability (health and safety, suppliers' carbon footprint)
		N52	There is a certificate related to the product/process received by the supplier.
		N53	Significant to evaluate suppliers in terms of quality, price, availability, and speed
N6.	Environmental Adjustments	N61	Significantly reduce the frequency of complaints / environmental accidents.
		N62	Increase the number of environmental standards and certificates by the business industry
		N63	Significant in increasing the compliance of complaints related to environmental standards

4. Research results

4.1. Economic Dimension

Based on the results of Fuzzy AHP, in terms of the economic dimension, there are three priority indicators that the palm oil industry must consider in assessing the performance of sustainable supply chain management after COVID-19. Table 4 shows the points respectively: adaptability (E6, weighted 0.325), supply chain cost (E3, weighted 0.245), quality (E5, weighted 0.148), and market competition (E4, weighted 0.036). In terms of adaptability (E6), the priority sub-indicator to consider is the ability to change the output level of the product produced (E63, weighted 0.704). Meanwhile, in terms of supply chain costs (E3), the storage cost sub-indicator (E32, weighted 0.660) is also a top priority. The significant decrease for orders that are not sent on schedule (E53) is the main sub-indicator considered in improving sustainable supply chain management performance in terms of quality (E5, weighted 0.490).

Table 4
Fuzzy pairwise comparison matrix: economic dimension

	E1			E2			E3			E4			E5			E6			W	Rank
E1	1	1	1	2	3	4	0.33	0.5	1	3	4	5	0.25	0.33	0.2	0.17	0.2	0.25	0.107	4
E2	0.25	0.33	0.20	1	1	1	0.2	0.25	0.33	2	3	4	0.17	0.2	0.25	0.17	0.2	0.25	0.057	5
E3	1	2	3	3	4	5	1	1	1	4	5	6	1	2	3	0.33	0.5	1	0.245	2
E4	0.2	0.25	0.33	0.25	0.33	0.2	0.17	0.2	0.25	1	1	1	0.2	0.25	0.33	0.14	0.17	0.2	0.036	6
E5	2	3	4	4	5	6	0.33	0.5	1	3	4	5	1	1	1	1	1	1	0.230	3
E6	4	5	6	4	5	6	1	2	3	5	6	7	1	1	1	1	1	1	0.325	1

Coeficient Reliability (CR) = 0.060 W: Eight

Table 5
The local and global weighting of each indicator from the economic dimension

Indicator	weight	Rank	Sub- Indicator	Local Weight	CR Local	Rank	Global Weight	CR global	Rank
E1	0.107	4	E11	0.106	0.06	3	0.013	0.06	
			E12	**0.606**		**1**	0.070		
			E13	0.048		4	0.006		
			E14	0.240		2	0.027		
E2	0.057	5	E21	0.129	0.08	3	0.019		
			E22	0.264		2	0.020		
			E23	**0.556**		**1**	0.038		
			E24	0.051		4	0.003		
E3	**0.245**	**2**	E31	0.099	0.04	3	0.025		
			E32	**0.660**		**1**	0.149		2
			E33	0.241		2	0.060		
E4	0.036	6	E41	0.071	0.05	3	0.002		
			E42	0.162		2	0.005		
			E43	**0.767**		**1**	0.024		
E5	**0.230**	**3**	E51	0.364	0.05	2	0.019		
			E52	**0.490**		**1**	0.091		
			E53	0.096		3	0.144		3
E6	**0.325**	**1**	E61	0.071	0.05	3	0.021		
			E62	0.225		2	0.066		
			E63	**0.704**		**1**	0.209		1

Source: Processed Data, 2020

Based on the synthesis results on the economic dimension, among 20 sub-indicators, there are three top priorities. Table 5 exhibits the order, respectively, the ability to change the output level of the product produced (E63, weighted 0.209), storage costs (E32, weighted 0.149), and a significant reduction in orders sent not on the schedule or delivery unreliability (E53, weighted 0.144).

4.2. Social Dimension

Fuzzy AHP also shows top priorities in the social dimension concerning assessing sustainable supply chain management's performance for the palm oil industry after COVID-19. Table 6 displays the rank, respectively health and safety (S2, weighted 0.483), consumer issues (S5, weighted 0.329,) social development (S1, weighted of 0.100), and workforce development (S3, weighted 0.036). In terms of health and safety indicators, the priority sub-indicator to consider is improving employee occupational health and safety (S23, weighted 0.502). As from consumer points, the sub-indicator of fulfilling consumer needs to achieve consumer satisfaction (S51, weighted 0.746) is also a top priority for attention. Then, significantly realizing an entity's social responsibility/concern to the community and the surrounding environment (S11) is the main sub-indicator considered in assessing the performance of sustainable supply chain management seen from social development with a local weight 0.598.

Table 6
Fuzzy pairwise comparison matrix: Social dimension

	S1			S2			S3			S4			S5			Weight	Rank
S1	(1	1	1)	(2	3	4)	(0.33	0.5	1)	(3	4	5)	(0.25	0.33	0.2)	0.100	3
S2	(0.25	0.33	0.2)	(1	1	1)	(0.2	0.25	0.33)	(2	3	4)	(0.17	0.2	0.25)	0.483	1
S3	(1	2	3)	(3	4	5)	(1	1	1)	(4	5	6)	(1	2	3)	0.036	5
S4	(0.2	0.25	0.33)	(0.25	0.33	0.2)	(0.17	0.2	0.25)	(1	1	1)	(0.2	0.25	0.33)	0.052	4
S5	(2	3	4	(4	5	6)	(0.33	0.5	1)	(3	4	5)	(1	1	1)	0.329	2
															Total	1.000	

Coeficient Reliability (CR) = 0.04
Source: Processed Data, 2020

Synthesis on the social dimension also found 17 sub-indicators. Table 7 shows the first to third priorities, respectively improving the health and safety of employees (S23), meeting consumer needs to achieve satisfaction (S51), and the significance of reducing work-related deaths (S22), each with a global weight of 0.329. 0.215. 0.121.

Table 7
The local and global weighting of each indicator from the social dimension

Indicator	weight	Rank	Sub- Indicator	Local Weight	CR Local	Rank	Global Weight	CR global	Rank
S1	0.100	3	S11	0.598	0.009	1	0.069	0.03	
			S12	0.072		3	0.038		
			S13	0.330		2	0.021		
S2	0.483	1	S21	0.116	0.009	3	0.033		
			S22	0.382		2	0.121		3
			S23	0.502		1	0.329		1
S3	0.036	5	S32	0.560	0.06	2	0.010		
			S31	0.227		1	0.025		
			S33	0.165		3	0.008		
			S34	0.048		4	0.002		
S4	0.052	4	S41	0.065	0.07	3	0.004		
			S42	0.266		2	0.016		
			S43	0.670		1	0.038		
S5	0.329	2	S51	0.746	0.005	1	0.215		2
			S52	0.162		2	0.046		
			S53	0.092		3	0.025		

Source: Processed Data, 2020

4.3. Environmental Dimension

Fuzzy AHP also exposes environmental dimensions. Table 8 manifests the three top priority indicators in assessing the performance of sustainable supply chain management for the sick oil industry after COVID-19, respectively sustainable supplier management (N5, weighted 0.458), energy efficiency (N1, weighted 0.216), waste management, and emissions (N4, weighted 0.138). From the indicators of sustainable supplier management, the priority sub-indicator to consider is evaluating suppliers in terms of quality, price, availability, and speed (N53) with a local weight of 0.704. As for energy efficiency, the sub-indicator of significant energy consumption savings (N13) is also a top priority for attention with a local weight of 0.856. The significant reduction in pollution due to smoke, waste pollution, hazardous materials, and others (N43) is the main sub-indicator considered in assessing the performance of sustainable supply chain management in terms of waste and emission management with a local weight of 0.678.

Table 8
Fuzzy pairwise comparison matrix: Environmental dimension

	N1			N2			N3			N4			N5			N6			Weight	Rank
N1	(1	1	1)	(2	3	4)	(2	3	4)	(1	2	3)	(0.2	0.25	0.33)	(4	5	6)	0.216	2
N2	(0.25	0.33	0.2)	(1	1	1)	(1	1	1)	(0.25	0.33	0.2)	(0.11	0.11	0.11)	(1	2	3)	0.061	6
N3	(0.25	0.33	0.2)	(1	1	1)	(1	1	1)	(0.2	0.25	0.33)	(0.25	0.33	0.2)	(1	1	1)	0.063	5
N4	(0.33	0.5	1)	(2	3	4)	(3	4	5)	(1	1	1)	(0.25	0.33	0.2)	(1	1	1)	0.138	3
N5	(3	4	5)	(9	9	9)	(2	3	4)	(2	3	4)	(1	1	1)	(6	7	8)	0.458	1
N6	(0.17	0.2	0.25)	(0.33	0.5	1)	(1	1	1)	(1	1	1)	(0.13	0.14	0.17)	(1	1	1)	0.064	4
																		Total	1	

Coeficient Reliability (CR) = 0.080

Source: Processed Data, 2020

Based on the synthesis results on the environmental dimension, 16 sub-indicators from the first to the third priority are to evaluate suppliers in terms of quality, price, availability, and speed (N53). Significant savings in energy consumption (e.g., electricity) (N13) and looking at ethical standards from suppliers including environmentally sustainable (N51), each with a global weight of 0.325. 0.147. 0.133. (Table 9).

Table 9
The local and global weighting for each indicator from the environmental dimension

Indicator	weight	Rank	Sub-Indicator	Local Weight	CR Local	Rank	Global Weight	CR global	Rank
N1	0.216	2	N11	0.064	0.030	3	0.015	0.070	
			N12	0.356		2	0.025		
			N13	0.580		1	0.147		2
N2	0.061	6	N21	0.144	0.000	2	0.015		
			N22	0.856		1	0.103		
N3	0.063	5	N31	0.126	0.000	2	0.008		
			N32	0.874		1	0.047		
N4	0.138	3	N41	0.253	0.050	2	0.014		
			N42	0.070		3	0.005		
			N43	0.678		1	0.046		
N5	0.458	1	N51	0.225	0.040	2	0.133		3
			N52	0.071		3	0.033		
			N53	0.704		1	0.325		1
N6	0.064	4	N61	0.086	0.020	3	0.005		
			N62	0.135		2	0.029		
			N63	0.779		1	0.050		

Source: Processed Data, 2020

5. Discussion

Adaptability is very appropriate to be the primary indicator to improve sustainable supply chain management performance in the palm oil industry after COVID-19, from an economic point of view. Adaptability is crucial as demand for palm oil from various export destination countries has drastically decreased or even totally stopped (Elfadina, 2020; Zuhriyah, 2020), while the supply of FFB (fresh fruit bunches) as the primary raw material for palm oil is also uncertain, which causes manufacturing activities to run slowly (Sofuroh, 2020). These findings are consistent with the study results by Karmaker et al. (2020) that adaptability has a strong influence in rebuilding supply chain management performance in the context of COVID-19. The adjustment needed to restore sustainable supply chain management's performance to face the risk of falling demand and uncertain supply is the ability to change the output level of the product produced (volume flexibility), which is the main sub-indicator of adaptability. From a social aspect, health and safety are the main priority indicators for assessing sustainable supply chain management's performance. Ağan et al. (2016) asserted the same thing: the importance of improving workers' health and safety in the practice of sustainable operational management. Companies' efforts to participate in social activities are taking into account the health and safety of workers (Aguiar et al., 2019). During this pandemic, the COVID-19 prevention protocol must continue to be implemented on plantations and employee housing. As with maintenance work and operations of palm oil processing factories, jobs with the potential for crowding, such as administration, are reduced by 50% to maintain physical distancing. From an environmental aspect, sustainable supplier management is an indicator that is a top priority for assessing sustainable supply chain management's performance. Partnerships with suppliers and supplier collaboration are seen as critical indicators (Akamp & Müller, 2013; Cruz, 2013; Leppelt et al., 2013). As a follow-up, suppliers' evaluation in terms of quality, price, availability, and rapidity is the most crucial sub-indicator in assessing sustainable supply chain management's performance. The notion is consistent with the

statement that companies must focus on improving their suppliers' sustainability performance by improving quality, rapidity, flexibility, and dependability (Vural, 2015).

6. Conclusions

6.1. Managerial Implications

In this study, sustainable supply chain management practices have been evaluated from the palm oil industry's perspective by determining important indicators that must be prioritized in sustainable supply chain management practices so that companies can survive amid this pandemic. It is expected that these findings may help companies to make the right decisions in managing their supply chains, considering that we must adjust to emergencies and uncertainties. In the meantime, policymakers are expected to assist palm oil trade and supply chain players, towards sustainable supply chain issues, in the context of the COVID-19 pandemic.

To restore and improve supply chain performance, the important things that companies must do immediately after COVID-19 are to increase adaptability, improve employee health and safety, and carry out sustainable supplier management. These indicators are constructive in achieving a resiliency level, as well as long-term success. These critical findings imply that it is necessary to carry out proper demand planning and evaluate which suppliers can continue to collaborate with the company. Additionally, maintaining company assets, such as healthy employees, is essential. Therefore, conducting continuous outreach on health protocols to employees is compulsory.

6.2. Research limitations and the follow-up

This research undeniably has limitations. First, the weighting of the economic, social, and environmental dimensions is assumed to be the same, even though in the field, they may differ depending on the interests and needs of the company in implementing sustainable supply chain management. Hence, this needs to be examined further by conducting a sensitivity analysis to present more scenarios in which the choice of prioritized indicators can be adjusted. Second, the expert groups as decision-makers only come from palm oil companies; in this case, they are only represented by related managers, not including customers or suppliers. Accordingly, it is anticipated that future decision-making can involve customers and suppliers so that the indicators suggested can better describe all supply chain actors' interests. Third, the method used in this study is Fuzzy AHP. In the future, other MCDM methods such as TOPSIS, VIKOR, ANP, DEA, and DEMATEL are also needed to compare the results of the recommended framework on sustainable supply chain management practices.

Acknowledgments

The writer would like to thank the Faculty of Agriculture, Tanjungpura University that has provided research funding assistance.

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