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Advocacy and Carbon Footprint Approach for Integration of MSMEs and Local Distributors to Actualize Food Supply Localization and Carbon Emission Reduction

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***Abstract*—The demand for MSME operator's vegetable and fruit supply demands in urban areas (Hinterland Area) is increasing, resulting in increased supply chain mobilization. The transport sector is the largest source of carbon dioxide (CO2). Therefore, encouraging carbon reduction and food localization can promote environmental sustainability. This research uses primary data collected from one distributor and three MSMEs in the South Tangerang area using carbon footprint calculations generated by light trucks. Then, an advocacy strategy in the form of direct interviews was used to integrate MSMEs into the nearest distributor. The results revealed MSMEs' supply of vegetables and fruits is quite far (>10KM) from the location, necessitating the usage of long transportation. On the other hand, the survey shows that there are nearby fruit and vegetable distributors in the MSME area. Therefore, connecting the nearest distributor is a strategy to streamline distribution activities. The results obtained reduced carbon emissions generated by 91.70% (CO2e) from changes in MSME vegetable and fruit distributors. Assisted by an advocacy approach, the targeted MSMEs successfully cooperated with the nearest distributor tentatively with supply types such as chili, shallots, garlic, and eggplant. Hopefully, MSMEs will eliminate large-scale/long-distance transportation distribution and develop an efficient supply chain.**

Keywords- Advocacy, Carbon Footprint, Food Supply, MSMEs, Localization

I. INTRODUCTION

Carbon dioxide is one of the greenhouse gases that is currently recognized as the main factor contributing to the increasingly severe climate change problem today [1]. High levels of carbon dioxide have become a global concern today, especially in Indonesia. The Nationally Determined Contribution (NDC) states Indonesia's commitment to dealing with climate change. The NDC is an action to reduce carbon gas emissions by the Paris Agreement in 2015 [2]. The commitment changes from year to year. In 2022 as of September, Indonesia focuses on the commitment to "Increasing Nationally Determined Contributions".

According to the NDC report (2022), the emission reduction target is divided into two: 31.89% (unconditional) and 43.20% (conditional). Unconditional is defined as the ability of each country (in terms of funding, technology, and capacity), to reduce GHG emissions by a certain amount. Meanwhile, conditional becomes support from external/international parties in the form of funding, technology, and capacity provided, so that GHG emission reduction efforts can increase.

Land transportation is the largest source of greenhouse gases (GHG) with 77% of total emissions from the transportation sector, and carbon dioxide is expected to continue to rise to 9.3 billion tons by 2030 [3]. In 2019, transportation mobility in Indonesia contributed to emissions of 157,326 Gg CO2e, with an average emission increase of 7.17% per year [4]. This explains that land transportation mobility contributes to a significant increase in carbon emissions.

Transportation in the food industry, especially in the food supply chain sector, has an important role in distribution activities from producers to consumers. The food industry is recorded to produce carbon dioxide emissions, which dominates carbon emissions by 71% [5]. The food supply chain in an area certainly uses land transportation to distribute according to the targeted area. Thus, supply chain activities are strongly related to the use of transportation which produces carbon emissions.

South Tangerang City is a city with a high level of business activity. The city has the second highest population density in Banten province. In Perinatology's research (2022) on regional interconnection, it can be concluded that theoretically DKI Jakarta is the nodal area and South Tangerang City is the hinterland area [6]. Although South Tangerang City is included in the scope of the metropolitan area, it is not a core area. According to data from the Entrepreneur Data Center (EDC) of South Tangerang City (2023), there are 140 thousand SMEs in South Tangerang City [7]. This density is followed by the number of transportation of 29,989 thousand [8].

The food supply chain is key in business activities. The distribution pattern to realize the supply of goods is inseparable from various things such as the supply chain of goods, the logistics transportation system, the existence of fuel scarcity, and other factors that are directly or indirectly related [9]. However, transportation between factories and retail centers has been shown to contribute the highest overall GHG emissions (45% - 50%) often due to long transportation distances [10].

Based on the research problem base that the researcher has described, the researcher aims to analyze the food supply chain activities of MSMEs in South Tangerang City. This study aims to determine the carbon footprint generated from the transportation of MSME food supply chains, provide strategies for localizing food supply through direct advocacy, and measure the level of carbon footprint efficiency after conducting supply chain localization programs.

II. RESEARCH METHOD

2.1 Data Collection

Data were collected from three MSMEs with different food needs and one distributor in Serpong, South Tangerang. The data is primary in nature which comes from the results of field observations twice. First, in May, fieldwork was used for a survey to see MSMEs and distributors around the Serpong area. Second, in June, field observations were used to conduct a localization program between MSMEs and distributors. Data collection aims to (1) find potential respondents in MSMEs and distributors to measure the transportation distance of the vegetable and fruit supply chain, (2) conduct an advocacy approach to integrate distributors and MSMEs in one area to reduce the carbon footprint, and (3) measure the efficiency of reducing transportation carbon emissions from the cooperation of distributors and MSMEs in one area.

2.2 Data Analysis

2.2.1 Advocacy Approach with In-Depth Interview

This research uses descriptive qualitative. The type of data used is primary data and the data collection technique used in this research is the advocacy method by means of observation and interviews. this technique is used to explore in-depth information to the sources that have been determined and then crosscheck the results of the interview [11]. The data analysis technique in the study began by conducting interviews with key informants, and then transcribing the interview results. The informants came from MSMEs and distributors.

SMEs Criteria	Micro Business	Small Business	Medium Enterprises
MSMEs are classified according to the criteria of business capital or annual sales proceeds.			
Net Worth/Business Capital	IDR 1 Billion at the most	> IDR 1 Billion - IDR 5 Billion	> Rp 5 Billion - Rp 10 Billion
Annual Sales Results	IDR 2 Billion at the most	More than IDR 2 Billion - IDR 15 Billion	More than Rp 15 Billion - Rp 50 Billion

Source: Government Regulation No. 7 of 2021 concerning Ease, Protection, and Empowerment of Cooperatives and Micro, Small and Medium Enterprises (PP UMKM) article 35 to article 36.

After conducting interviews, the research then provided advocacy for the food supply chain integration program. Advocacy is an attempt to influence public policy through various forms of persuasive communication [12]. It is hoped that the involvement of researchers as a third party (liaison) can be a solution to the supply chain challenges experienced by the interviewees.

2.2.2 Carbon Footprint Calculation Method

This study uses a model to calculate the carbon footprint of internal transportation based on the energy consumption of transportation equipment used during its operation [13]. The objective of this assessment was to measure the Carbon Footprint of the land transportation distance used for the delivery of vegetable and fruit food supplies from distributors to MSMEs. The Carbon Footprint was assessed in order to visualize the potential contribution of transport, vegetables, and fruits to climate change.

Predicting transportation emissions requires detailed traffic data [14]. The data required is the quantity and volume of land transportation within a region. Thus, the limitation of this research is in the area around South Tangerang.

In general, greenhouse gas emission calculations are divided into three tiers which indicate the quality of different calculation results. There are variations in the quality, accuracy, and uncertainty of calculation results at each tier. The higher the ties used, the more accurate the greenhouse gas emission calculation results will be, but it requires more comprehensive data [15]. This research uses tier 1 to calculate greenhouse gas emissions resulting from the distribution of vegetable and fruit food supplies. In general, the formula used is [16]

$$GHG\ Emission\ =\ Data\ Activity \times\ Emission\ Factor$$

In the context of calculating greenhouse gas emissions, activity data and emission factors can be adjusted according to the activity being calculated.

2.2.3 Carbon Footprint by Transportation Formula

More specifically, distribution system calculations using land transportation can be done using a tool in the form of Excel which has been simplified by the United States Environmental Protection Agency (EPA) with the activity data used being fuel use-based on transportation distance with emission factors based on the type of vehicle used. namely diesel light-duty trucks [17]. The emission factors used are as follows:

Vehicle type	CO_2e Factor (kg/unit)
Light-duty truck	0,467

Source: US EPA, 2021

The emission factors used are then substituted into the greenhouse gas emission calculation formula for the land transportation distribution system [18].

$$Emission_{GHG\ fuel} = Fuel\ Consumption \times Emission\ Factor$$

III. Result and Discussion

3.1 Calculating Carbon from Transportation (Before local partnership)

The results revealed MSMEs' supply of vegetables and fruits is quite far (>10KM) from the location, necessitating the usage of long transportation. The study focus in this area is on quantifying carbon emissions from the transport sector before the formation of local partnerships. Before engaging with local entities, this preliminary analysis is used to examine the environmental implications of transportation initiatives. The following is the initial calculation data used with several components taken into consideration.

Description	Category	Transportation Distances (miles)	CO2e (kg)
Kebun Latte Café	Upstream T&D	6,4	2,7213
Loko Moko Cafe	Upstream T&D	8	3,6284
Kuilo Cafe	Upstream T&D	6,2	2,7213
GHG Emission Total			**9,0710**

Source: Primary Data

The term "Upstream Transportation and Distribution" in carbon emission calculations refers to the transportation and distribution activities of raw materials and starting materials used as basic ingredients for a product. In the GHG emission calculation, Upstream Transportation and Distribution are categorized in scope 3 [19]. According to the data in the table above, the average carbon emissions produced by the three MSMEs are roughly 3 kilograms of emissions or the equivalent of 3 kg CO2e. According to available data, the total amount of GHG emission generated is 9,07 kg CO2e, and the average distance traveled for raw product transportation is 6,8 miles. This presents an overview of the environmental effect of company sustainability in terms of carbon emissions and distribution efficiency.

3.2 Calculating Carbon from Transportation (After local partnership)

The calculation of emissions produced in the distribution sector after collaborating with local entities is as follows:

Description	Category	Transportation Distances (miles)	CO2e (kg)
Kebun Latte Café	Upstream T&D	0,08	0,02721
Loko Moko Cafe	Upstream T&D	0,8	0,27213
Kuilo Cafe	Upstream T&D	1,4	0,45355
GHG Emission Total			**0,75289**

Source: Primary Data, 2023

Based on the data table above, it shows a significant reduction in GHG emissions due to reduced travel distance, namely an average of 0.73 miles for the three MSMEs. The carbon emissions produced can be reduced to an average of 0.2 kg CO2e with the total GHG emissions produced after the collaboration being 0.75 kg CO2e.

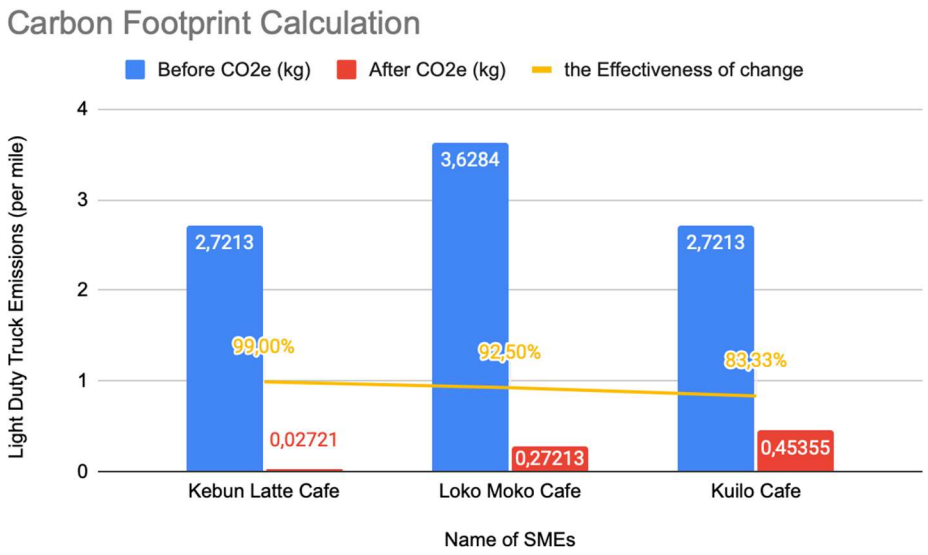

Figure 1. Carbon Footprint Calculation

The bar chart above shows the outcomes of three MSMEs' measures to reduce carbon emissions. The above figures indicate the CO2 emissions generated by the transportation used in the distribution of raw commodities. The total amount of emissions per mile is determined by the number of miles driven by each truck, the type of truck, and its efficiency. The final results reveal that partnering with local parties will decrease distribution distances and carbon emissions by 91.70%.

3.3 In depth-Interview Result

Interviews were conducted by visiting each MSME located in the Serpong area, South Tangerang. MSMEs consist of Kebun Latte Cafe, Loko Moko Cafe, and Kuilo Cafe.

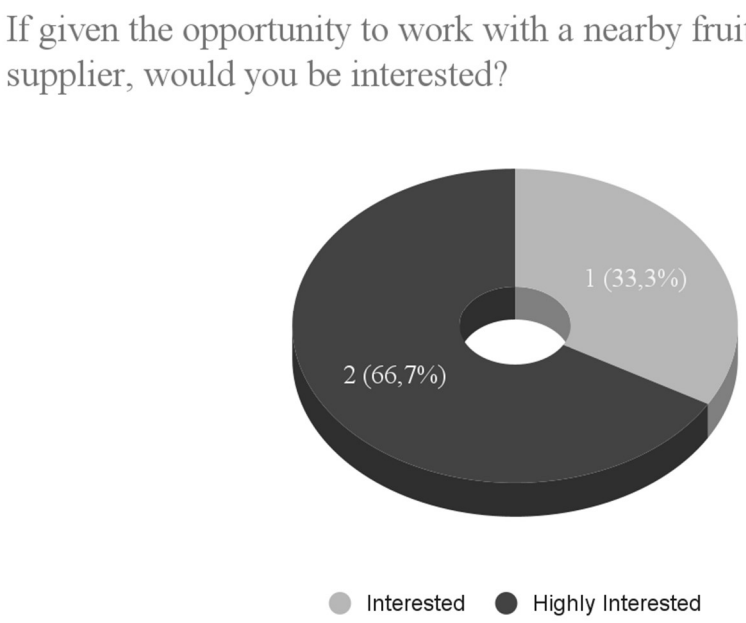

Figure 2. Interest in cooperating with MSMEs for preferred food distributors

The pie chart shows (Figure 1) that all interested (33.3%) and very interested (66.7%) respondent MSMEs are located in the Serpong, South Tangerang area. These three MSMEs will be put together in one distributor with food choices consisting of chili, shallots, garlic, and eggplant on a tentative basis (demand may change).

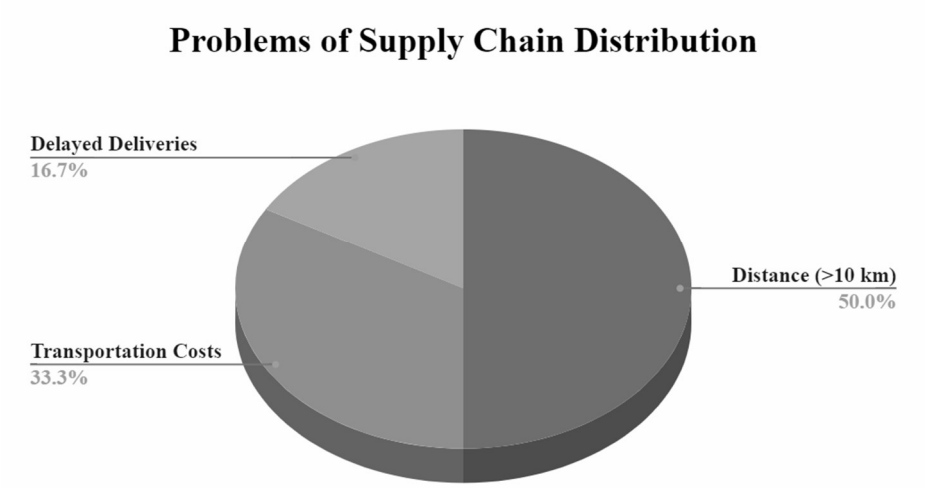

Figure 3. Problems of Supply Chain Distribution among MSMEs

In their supply chain activities, there are several difficulties experienced by respondents. All respondents agreed that the distance to the raw material supplier is more than 10km. Two out of three respondents also said that this caused transportation costs such as gasoline to be high even though they only took small amounts of raw materials. In addition, according to one respondent, sometimes goods are delayed in delivery due to traffic jams or the absence of a driver from the distributor.

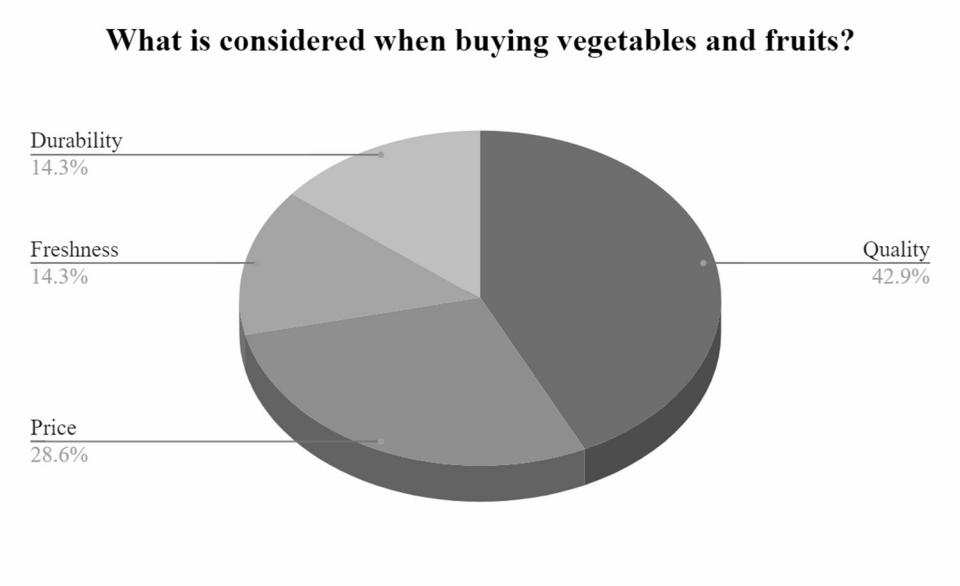

Fig 4. Consideration of MSEMs while buying their raw materials

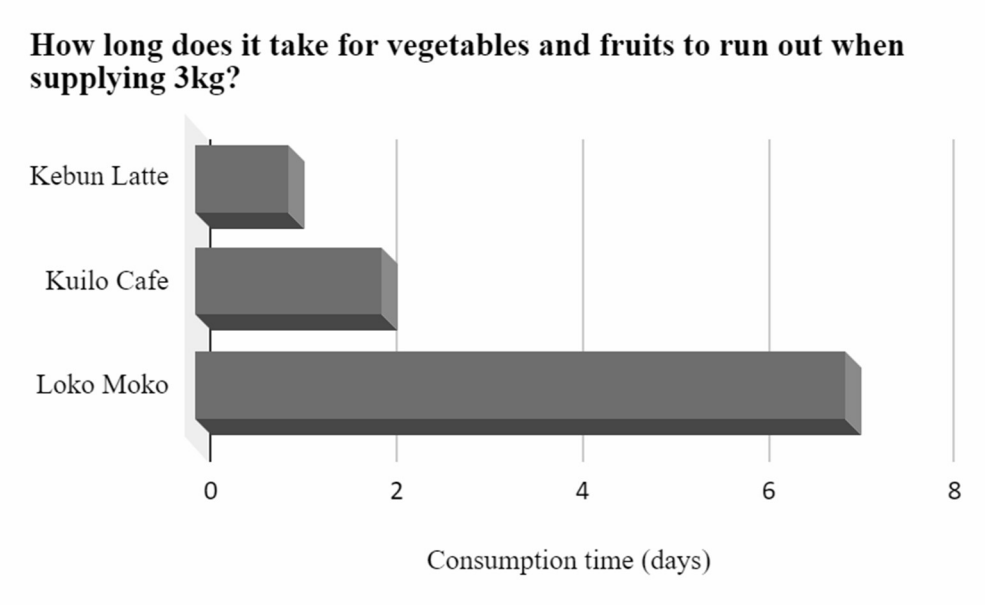

Figure 5. Consumption Timeline of Raw Materials

As for considerations in buying raw materials in the form of tomatoes, chilies, etc., all respondents agreed that the most important thing to consider is the quality of raw materials. Furthermore, two out of three respondents also considered the affordable price of raw materials. The freshness and durability of raw materials were also recognized as significant factors, especially considering that the use of these raw materials tends to be carried out within a certain period. Each cafe has its variation in the use of raw materials. For example, Kebun Late takes 1 day, Kuilo 1-2 days, and Loko Moko 5-7 days to finish 3 kg of raw materials. This variation can be adjusted to the characteristics and menu of each cafe.

3.4 Advocacy Program as an approach to localization of Distribution and MSMEs in Vegetable and Fruit Supply Chain Activities.

The advocacy approach is used to integrate food distributors and MSMEs in one close area. Social advocacy can be interpreted as an approach to other people who are considered to influence the success of a program or activity being implemented [20]. The advocacy process can be seen in Figure 6.

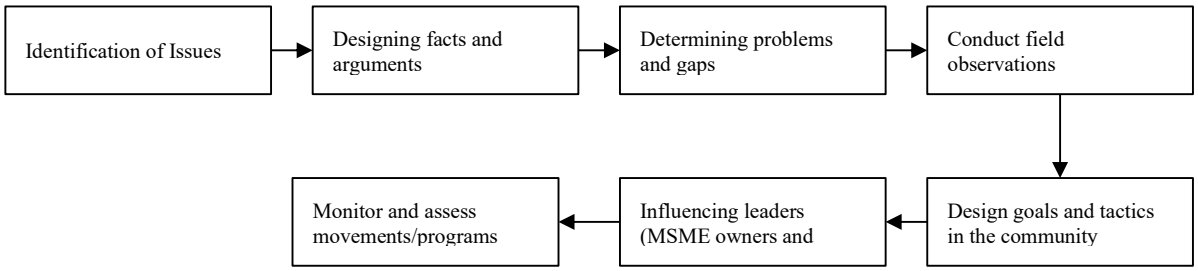

Figure 6. The advocacy process

The researcher becomes a liaison actor between distributors and MSMEs. Advocacy is carried out by communicating and making offers to the MSMEs that we have reached. All scopes of communication carried out have the same goal, namely: influencing the recipient's attitude, for example, the target party changes its behavioral attitude, according to the will of the sender of the information [12].

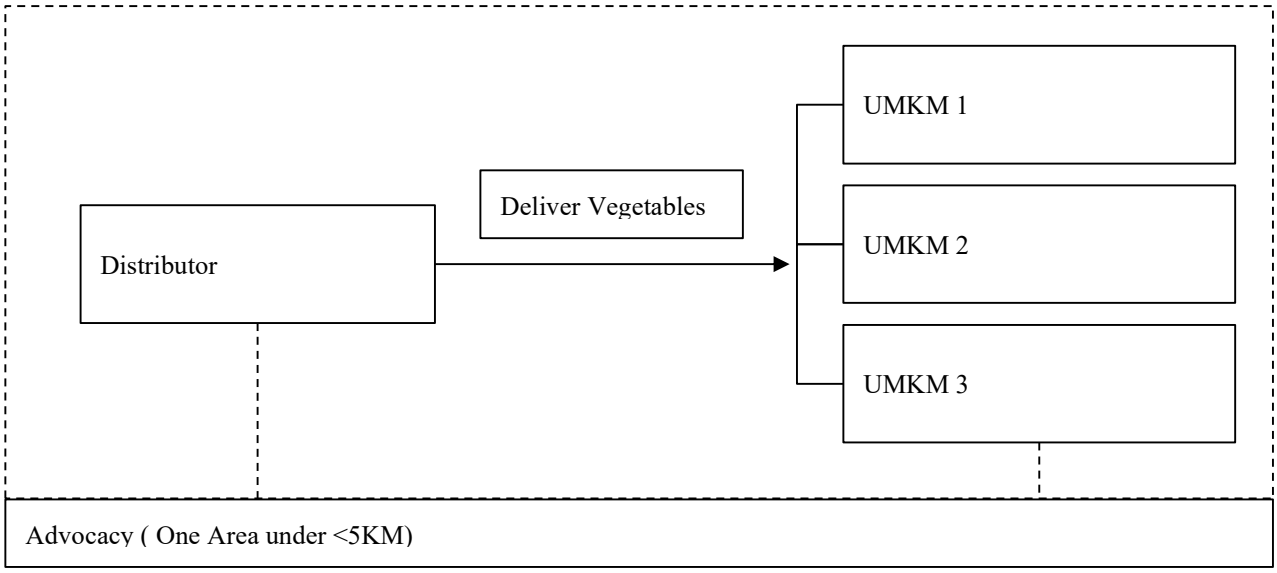

Figure 7. The supply chain integration mechanism

Source: Processed by Researchers (2023)

The choice of distributors are vegetable and fruit suppliers that are very close to the surrounding MSME areas. The distance between each MSME is under 5 kilometers. This is an opportunity for MSMEs to reduce supply chain transportation costs, avoid delays in the delivery of goods, and keep food quality fresh.

3.5 Managerial Implication

This study contributes to our understanding of the impact of food supply chain transportation on reducing carbon emissions. This critical understanding helps align the measures to be taken to achieve the 2030 sustainable development goals. It

should be emphasized that encouraging the development of localization of food supply chains within one region will be one of the important steps to reduce transportation mobilization considering that one of the highest sources of carbon emissions comes from land transportation. The closer the distance traveled, the less carbon emissions generated. Moreover, localizing the food supply chain will improve the welfare of food distributors in the South Tangerang area. Therefore, researchers provide an advocacy approach for the government to consider investing in efficient food supply chain activities to improve environmental sustainability and prevent global warming. Policies are also needed to improve coordination between Indonesian environmental protection and the UN so that conflicting synergies between these two forces can converge and improve the UN framework [21].

IV. Conclusion and Recommendation

The research presents the level of carbon emissions generated by land and food transportation from food supply chain activities in one area (Serpong, South Tangerang), proves the efficiency of carbon reduction as a result of the integration of distribution and MSMEs in a short distance, and advocates for their cooperation in food supply chain activities. The calculations provided are based on the results of researchers' field observations in the hinterland area with the hope of informing further research on business activities in the hinterland area, especially on food supply chain management activities.

In the advocacy approach for food supply chain localization, this analysis is oriented towards the products that are requested the most by the MSMEs that are the resource persons in this study. In order to improve a more comprehensive analysis, it is important to concentrate on (1) local food potential, (2) digital channels in business activities used, and (3) the size of food demand for MSMEs. This indicator needs to be discussed for future research. It is even more optimal to analyze sustainable supply chain management strategies.

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