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Food Logistics Quality: Minimize Damage to Fresh Fruit Shipping in Covid-19 Era

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ABSTRACTS

Foods are the primary resources that are critical to all of people in the world. Commodity food needs of fruits are needed by considering their quality. During the current Covid-19 pandemic, the demand for food delivery needs has greatly increased. The problem arises when the quality of the fruit is not proper, it is damaged during delivery. This article aims to capture the quality of the fruit and how to minimize the damage in shipping. The method used in this study is a literature review using the source of scientific articles published in the last 10 years (2011-2021). The results of this study indicate that temperature, storage are the main factors in fruit delivery. In addition, In order to minimize the damage risks to the freshness of the fruit that being shipped, the use of fresh fruit in shipping, the use of a GPS-based temperature sensor is very good in maintaining the temperature during delivery as well the accurate information in real time.

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1. INTRODUCTION

Changes that occur in the world cannot be predicted accurately, including the Covid-19 pandemic which has occurred about a year since 2020. This change shows the importance of the logistics sector as an industry that helps people meet various needs of daily life (Gül Senir, Arzum Büyükkeklik, 2020). The transformation process towards digitization is a process that has become the center of attention in the logistics industry. As time goes by and the development of science and technology, various innovative systems and technologies are continuously developed to support the distribution of goods to the customers as effectively and efficiently as possible (Kersten, et.all., 2019). Facing the Industrial 4.0 era, logistics companies should carry out digital transformation. However, the current transformation process is not yet perfect, there are still frequent deficiencies in the logistics distribution system used today.

One of the shortcomings in the logistics distribution system which is a crucial problem is that customers often receive goods that are damaged during the distribution process. For example, in a study it was stated the results of observations made on distribution handling activities, found 1091 cartons of defective products in ultra high temperature dairy products.

Due to the lack of logistical activities may have a severe impact to the distribution process of fruits. In fact, during this pandemic, the demand for fruits has increased rapidly. According to the Ministry of Agriculture of the Republic of Indonesia (2020), the level of consumption of fruits and vegetables during this pandemic is a priority where people are increasingly aware of the benefits of fruits and vegetables that contain lots of vitamins, in order to increase the body's immune system. With the high demand and need for fruits, it is also necessary to fulfill these needs on a large scale. Quoting data from the Central Statistics Agency (BPS), during the period from January to May 2020 the demand for fresh fruit exports reached 375,000 tons. In fact, the added value of exports has increased by 73.4 percent over the same period in 2019. It is projected that fruit exports will continue to increase during the pandemic (Hidranto, 2020).

Logistics now day was expected to meet the high demand due to this current situation, and it will increase for certain. However, it is not uncommon to find cases of loss in the form of rotten fruits on the way in the distribution process. An example of a case was experienced by residents of Gempol Sari Village who received rotten fruits from the Non-Cash Food Aid (BPNT) Family Hope Program (PKH). It is not clear when the fruits began to rot, but one of the allegations is that the fruit could rot while on the way (Aditya, 2020). Therefore, technology is needed so that it can minimize the risks of loss and increase the satisfaction for both consumers and sellers for consumers and sellers. One of the technologies that can be applied is the Motion and Temperature Sensory (MATS) System technology which can detect vibrations and provide information about the room temperature or the vehicle where the fruits to be sent are stored. Vibration and temperature are factors that can affect the speed at which the fruits decompose. With the existence of a vibration sensor, mechanical damage or collisions that will occur to the fruit being transported can be minimized. Mechanical damage can be caused due to collisions on commodities (W. Sudjatha and Ni Wayan Wisaniyasa, 2017). Bruised fruit will rot faster, have lower storage capacity, have faster respiration, the ethylene hormone is more active so that the ripening process and respiration rate are faster so that the fruit will rot faster, compared to fruit that is not bruised. So maintaining the quality of fresh fruit in delivery is very important, in addition to maintaining customer satisfaction, of course maintaining the quality of goods is the focus of the delivery service. So this study will reveal the proper way to maintain food quality, especially in the type of commodity food with fresh fruits.

2. METHODS

This research was conducted using the Literature Review method, which in its stages searches for data sourced from reputable scientific journals and official websites with restrictions on the last 10 years (2011-2021) which contain scientific articles needed to provide information about food quality, especially fresh fruit. in delivery during this Covid-19 pandemic. After doing a search with several keywords including: quality food, shipping, fresh fruit shipping, food logistics, covid-19 pandemic. The next stage is sorting Where authors sort the article according to the needed for supporting the objectives in this study. Next is the analysis and synthesis phase of the scientific articles used as references in this study. Then the stage of pouring the results of the session into articles in order to answer the purpose of writing this scientific article.

3. RESULTS AND DISCUSSION

Logistics is positioning resources at the right time, at the right place, for the right cost and for the right quality (Walker & Jones, 2012). In addition, logistics is the management of the flow of goods and services between points of origin and points of consumption to meet customer needs (Yasseri et al., 2012). Logistics is an industry consisting of process-oriented businesses that focus on managing the flow of resources, both material and abstract, from point of origin to destination. On the other hand, logistics processes often include complex processes due to the differences in the means of transportation used and the parties involved. (Cabanilla et al., 2013).

From the definition previously described, it can be concluded that logistics is the flow of goods or services starting from the starting point as the source to the destination, namely consumers with various processes, including the planning, implementation, and control of efficient and effective flow of goods, services, or information that aims to meet consumer needs. In the era of the industrial revolution 4.0, changes occur quickly, amid the Covid-19 pandemic, forcing a fast digital acceleration process in the logistics industry. The concept of digitizing logistics is to allow transparency at all times from suppliers to customers or in other words there must be transparency along the supply chain (Kayikci, 2018).

The intended digitization is the increased availability of digital data made possible by advances in creating, transferring, storing, and analyzing digital data, and has the potential to structure, shape and influence the contemporary world (Barczak, Agnieszka, Izabela Dembińska, & Lukasz Marzantowicz., 2019) .

3.1 Fresh Fruit Quality

Fresh fruit is one type of food commodity that is highly sought after during the Covid-19 pandemic. Several types of fresh fruit have very high benefits because of their vitamin content which can increase, increase and maintain body immunity which is an absolute requirement in maintaining health. When modeling fruit quality as perceived by end consumers, it is important to identify how changes in metabolic rate are measured as fruit quality (MLATM Hertog, BIOSYST-MeBioS, KU Leuven, Leuven, Belgium, 2016). A standard must be applicable in all areas where it is used; otherwise it will become a technical barrier to trading. By providing a mutually agreed upon product description, the standard clarifies the buyer's requirements for manufacturers, sorters, and packers. This reduces misunderstanding and profits. Quality standards can increase waste by limiting the lowest acceptable quality, if there is a demand for a product with a quality below the lowest acceptable standard and if such standards are mandatory.

But if standards truly reflect market requirements, they will not increase waste because buyers will have the same requirements even if standards do not exist. To some extent, the effects between standard setting and market requirements are reciprocal. When standards are being designed or changed, requirements need to be set at the correct levels. Requirements that do not affect dietary quality, maintain quality or nutritional value can increase waste and / or use of pesticides and fungicides without increasing consumer satisfaction. Greater consumer knowledge and awareness, however, will result in less waste and less use of chemicals. Thus, producers, traders, retailers, consumers and standard-setting bodies all have a role to play in reducing waste and chemical use in the production and distribution of fresh fruit and vegetables (Mattsson, K., 2015). On delivery, the temperature standards that are set to maintain the quality of fruit in shipping can be seen in table 1 below:

Table 1. Fruit Temperature Standard Table When Delivering

Product	Temp in ℃	% Relative Moisture	% O2	% CO2	Ethylene	
					Expels	Sensitive
Banana	12-14	85-100	2-5	3-5	+	+
Bean Sprouts	0	90-98	5	15	+	
Mushrooms	0-5	90-98	5	10		+
Tomato	12-20	90-98	3-5	5-10	+	
Tomato (Ripe)	8-12	85-98	3-5	5-10	+	+
Broccoli	0-5	90-95	2	5	+	++
Cucumber	8-12	90-95	3-5	0		++
Head of Lettuce	10-15	95	2-5	0		++
Capsicums	8-12	90-95	3-5	2	+	+
Grape	10-15	85-90	3-10	5-10		
Peach	0-5	90	1-2	5	+++	+
Apple	0-5	90	2-3	1-2	+++	+
Pear	0-5	90-95	2-3	0-1	+++	+
Plum	0-5	90-95	3	8		+
Strawberry	0-5	90-95	10	15-20		

Source: www.dmckargo.com

There are various kinds of Perishables and each product has different characteristics, especially horticultural products (fruits, vegetables, and flowers, etc.). Packaging and product handling standards, as follows (Source: www.dmckargo.com):

1. Choose a package that is in good condition, strong and fit for use.

2. Packaging must be able to protect the product in good condition and consumed by time, such as use in general and friction during shipping. The packaging must be able to protect the products inside from damage caused by the packaging itself, such as environmental change factors (temperature, weather, humidity, etc.).

3. The packaging must be strong enough to keep the product inside if the packages are stacked up to 3 meters with packages of equivalent weight, at least 24 hours without damage to the packaging at the bottom.

Based on the information obtained and applied in the delivery of fruits, packaging is of course the main requirement, where in the packaging more attention is needed. Packaging can be done as illustrated in Figure 1 below:

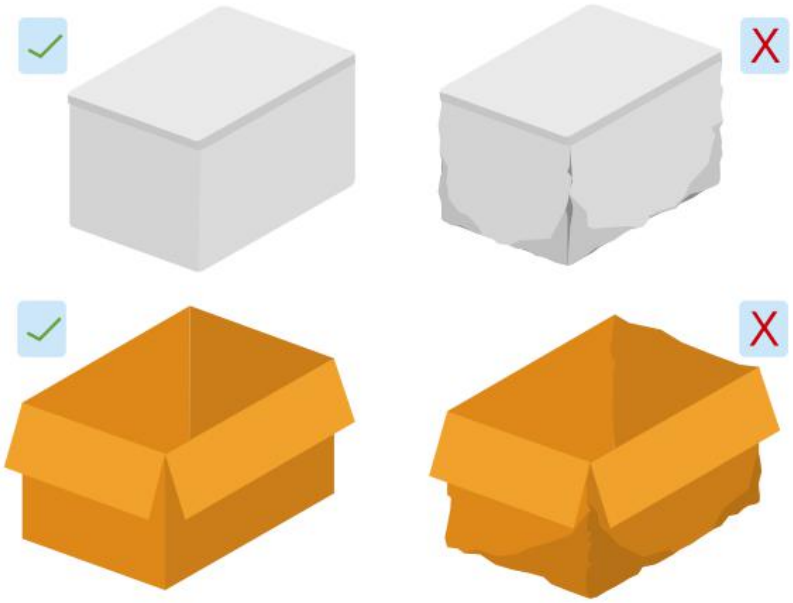

Figure 1. Sterofoam Packaging and Box
Source: www.dmckargo.com

After knowing the temperature information on each fruit in shipping, it is very important to pay attention to it as described in table 1.Then in the delivery of fruit requires two types of packaging consisting of stearofoam and box packaging as illustrated in Figure 1.The next stage in maintaining fruit quality -Materials during delivery are the packaging stages that must be careful with due regard to the characteristics of each fruit to be sent. During a Covid-19 pandemic like this, it is very important to be able to maintain the quality of fruits. Some of the steps that need to be done until packaging before delivery can be seen in Figure 2 below:

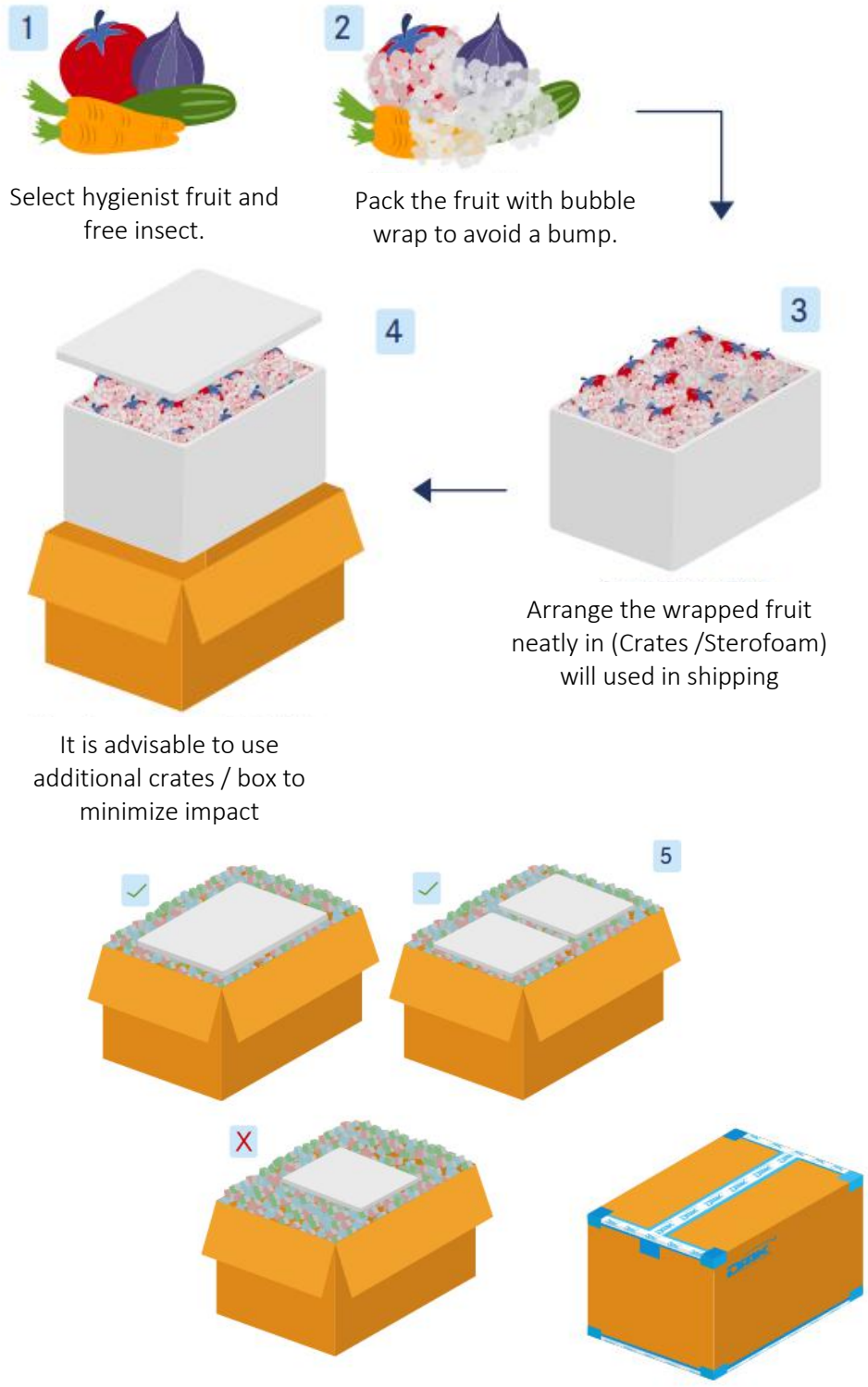

Figure 2. The Order of Fruit and Vegetable Packaging Procedures
Source: www.dmckargo.com

Some notes that need to be considered in carrying out the packaging stages as illustrated in Figure 2, including: avoiding empty space in the package, too much foam or cushioning in the box, it can reduce the strength of the box. In addition, what must be considered is good sealing and labelling in order to provide convenience to consumers when receiving the fruits that are shipped.

3.2 Live Monitoring System

Logistics monitoring and management is currently considered an important issue for global companies because this aspect has a strong and growing impact on the tracking and tracing of logistics networks (Shamsuzzoha et al., 2013). This is expected to be one of the driving factors in maintaining satisfaction between clients, producers, suppliers and potential customers (Claesson & Hilletofth, 2011). The use of monitoring and tracking systems is important to reduce costs and ensure smooth identification of operational bottlenecks and defects (Shamsuzzoha & Helo, 2011).

Distribution in the logistics industry, of course, involves many goods at one time. The number of items sent at one time makes it difficult to check the position of the goods being sent. This situation is made more difficult because it uses a passive GPS (Global Positioning System) system as a tracking system for goods that requires a trigger by sending an SMS (Short Message Service) to a GPS device to obtain location data on the vehicle transporting goods that are distributed.

The system consists of monitoring vehicles in real time without the need to ask for information from the vehicle unit. Real time technology can minimize the lag time for the monitoring system as quickly as possible. Information on the location of vehicles containing goods that are distributed can be immediately known when the vehicle is moving towards the end point. Not only information, the condition of the goods in the vehicle can also be known in real time through the camera installed in the vehicle and connected to the existing GPS. This real time tracking and live monitoring technology can be combined with the Android mobile system so that it can be accessed by anyone, anywhere.

There is research that has been done previously regarding the real time tracking system using an Android device, namely research conducted by Satya Wacana Christian University Informatics Engineering student Ramos Somya with the title "Android-Based Real Time Vehicle Monitoring System using CouchDB Technology at PT. Pura Barutama "The comparison of this study with previous research is the use of live monitoring technology combined with a real time tracking system. Applications that have been made previously only use a real time tracking system without live monitoring technology. The combination of a live monitoring system with real time tracking allows consumers to monitor their goods directly from a distance. Technology can assist monitoring through a monitoring system installed on the transposition tool used in distribution as illustrated in Figure 3:

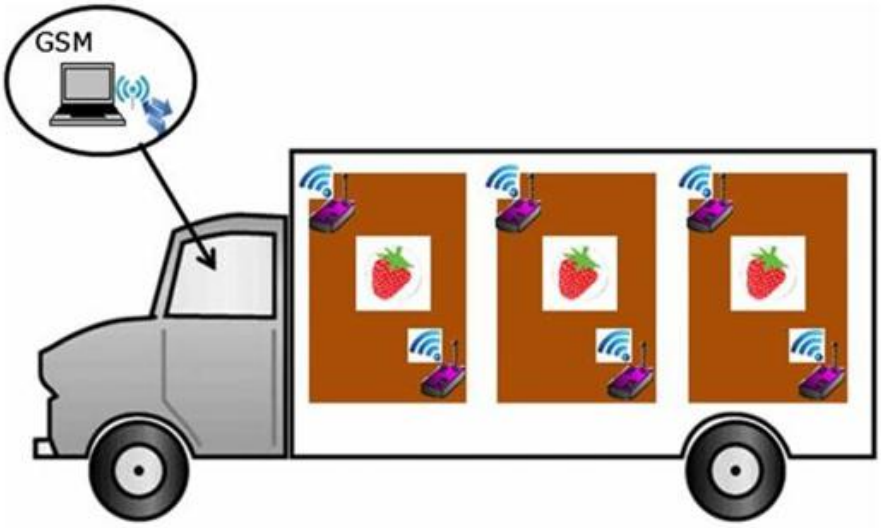

Figure 3. Monitoring System for Food Delivery with Wireless Technology
Source: Badia-Melis, R., 2016

Many of our technological advances have been completed. There are new concepts that are created to complement technological advances, and track logistics activities using technology. Combined with the IoT, it will be possible to train the system, and the system will learn and improve procedures. Temperature estimation can be key in this case, saving money and reducing tool management operations. These predictions make shipping more predictable, and it is possible to keep track of the chain and predict what will happen next and minimize the occurrence of damage, especially to spoiled foods. Multi-sensor technology already exists in supply chain transportation that can be tracked via a laptop / computer for frozen food and fresh agricultural products such as peaches (Wang, X .; Mateti´c, M .; Zhou, H .; Zhang, X .; Jemri´c, T, 2017), pears (Liu, J .; Zhang, X .; Li, Z .; Zhang, X .; Jemric, T .; Wang, X, 2019), fish (Zhang, Y .; Ning, Y .; Zhang, X .; Glamuzina, B .; Xing, S., 2020), shells (Feng, H .; Wang, W .; Chen, B .; Zhang, X., 2020) and good influence towards food quality management. Food delivery must pay attention to the quality of the food itself, so that in real time monitoring system design needs to be considered.

Sensory evaluation is used to analyze food quality, whereas a multi-sensor based method for dynamic monitoring quality analysis is more precise, accurate, reliable and multi-faceted. Multi-sensor technology already exists in supply chain transportation that can be tracked via a laptop / computer for frozen food and fresh agricultural products such as peaches (Wang, X., et.al, 2017), pears (Zhang, Y., et.al) ., 2020), fish (Feng, H., et.al., 2020; Zhang, Y., et.al., 2020), shellfish (Feng, H., et.al., 2020), and have a good effect towards food quality management. More clearly can be seen in table 2 below:

Table 2.Cherries Business Flow according to Hazard Analysis Critical Control Point (HACCP)

Stage	Critical Control Point (CCP)	Hazard Analysis (HA)	Stakeholders	Control Measures
1	Harvesting	Pests and diseases, immature, decay, pesticide residue.	Farmers, picking staff	The picking process should be standardized to avoid harvesting substandard sweet cherries.
2	Sorting, grading, packaging	Non-standard sorting and grading methods, poor operating environment, unreasonable packaging	Farmers, workers	The standardized sorting and grading methods should be adopted, clean and hygienic working environment should be guaranteed.
3	Pre-cooling	No complete pre-cooling, cross-infection.	Cold storage management staff	The complete pre-cooling and clean pre-cooling environment should be ensured.
4	Short-distance transportation	Transportation factors such as packaging, vibration, temperature, etc.	Transport personnel	The suitable packaging method and temperature control measures could be provided, violent vibration should be avoided.
5	Express transportation	Unsuitable storage and transportation, unstandardized operations, lack of process management	Express companies	Reasonable storage and transportation condition should be provided, standardized operations and process management should also be emphasized.
6	Long-distance transportation	The freight density, transportation condition, haulage time.	Transport personnel	Reasonable loading density, critical microenvironment, transportation time should be taken into consideration.
7	Sales or Display	Improper temperature or relative humidity control cause browning or rotting.	Supermarket Salesman Saleswomen	The sales or display environment should be controlled in a suitable range.

Sources: Xiaoshuan Zhang., et.al., 2020

Based on the information obtained through various characteristics of the fruit then the temperature and storage information that has been described. So the temperature control is one of the efforts to maintain the quality of the fruit itself in ongoing shipments. This monitoring activity is carried out directly and in real time so that during delivery, drivers who carry fruit orders to consumers via land transportation will be able to know the temperature conditions of the fruits being carried. Then it can be reported and can be seen through a direct monitoring system using GPS as illustrated in Figure 3.

During the current Covid-19 pandemic, the demand for fresh fruit has greatly increased. So the delivery process really needs good quality. In addition to direct monitoring of temperature conditions during fruit delivery. All shipments of goods must be packed according to standards. The products to be sent ensure that there is packaging material (Bubblewrap, bearings / cork) to protect the product from collisions during delivery. Replacement of packaging materials (Bubblewrap, bearings / cork) is recommended during delivery to anticipate thinning / brittle bearings, to provide protection for packages sent from the load of other packaging piles. Sealing and labeling must follow each packaging guide on the individual product. All necessary labels must be put in accordance with international regulations and national laws. To maintain the temperature of the product being sent, you should use a cooling material such as a gel pack or dry ice. Especially for seafood packaging such as lobster, fish, etc., it is better to use gel packs than dry ice. If the use of ice cubes in general has a lot of losses in terms of weight and water resistance on the packaging, and there are additional requirements that must be completed. The temperature in the delivery area must be adjusted to the perishable product for Priority Express Cargo vans and trucks.

4. CONCLUSION

Food delivery, especially fruit commodities, has its own challenges. On delivery it is necessary to pay attention to the types and characteristics of the fruit itself. In addition, the type of packaging and tools and the stages that are carried out must be correct, so that delivery can be carried out properly. Temperature is an indicator that is very important to pay attention to, therefore monitoring temperature through direct monitoring sensors is very important. The real time monitoring system will provide more accurate information for senders and recipients via GPS, which will send reports of updates on the condition of the goods to the end consumer via SMS, which is sent periodically at each transit point. This effort is carried out as a way to guarantee good quality for consumers in receiving the fruits that have been ordered.

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