

# Development of Green Logistics Management Model for the Sustainable Environmental Quality of Thailand's Palm oil Mills in the Future

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## Abstract

The objectives of this research were 1) to study the development guidelines of the Green Logistics Management Model for the sustainable environmental quality of Thailand's palm oil mills in the future 2) to develop the management model of the Green Logistics for the sustainable environmental quality of Thailand's palm oil mills in the future, using a future research technique known as EDFR (Ethnographic Delphi Futures Research) technique. The samples were twenty-four experts with knowledge and experience in green logistics management and oil palm who were selected by using purposive sampling. The research's tools were interview guidelines and estimation scale questionnaires. Data collection was carried out in three rounds. The first round was an interview and then the collected data was used to create the estimation scale questionnaires. In the second and third rounds, the data obtained from the final questionnaire were analyzed by the Median, Mode, the difference between Mode and Median, and the interquartile ranges (IQR). These were checked the format by referring to qualified persons (Connoisseurship).

The results showed that the development of the Green Logistics Management Model for the sustainable environmental quality of Thailand's palm oil mills in the future the management model of the Green Logistics based on the importance of concepts, activities, and factors that result in green logistics management consists of four aspects as follows: 1) Green process Implementation 2) Human capital 3) pieces of equipment and 4. Information.

**Keywords:** Green logistics management model, palm oil mills, sustainable environment Environmental quality, development of green logistics management model

## Introduction

Environmental conservation is a wise use of natural resources and the environment by using fewer available resources but the maximum benefit. Thinking about the duration of use for long-time results in damage minimal environment including the need to distribute the use of natural resources thoroughly. At present, natural resources and the environment are deteriorating. Consequently, conservation of natural resources and the environment are meaningful as well as the development of environmental quality as well. At present, the world stage has seen the importance of environmental problems in terms of air pollution caused by transportation, energy use in the production process, and packaging materials. Most of the logistics management for various industries focus only on reducing logistics costs to increase competitiveness without considering the environment as it should be. The reduction in logistics costs leads to a reduction in environmental impact, so Green Management Logistics for Sustainable Environmental Quality is a suitable development approach to environmental management. A process to increase the efficiency of delivery management from the manufacturer to the consumer can increase the capabilities of the business and industry in terms of reducing production costs, adding value energy-saving, and environmental conservation.

Thailand attaches great importance to the development of logistics systems to support its position as a center of trade, service, and investment in the region including support increasing the country's competitiveness. The Office of the National Economic and Social Development Board has a mission to formulate guidelines Policies and Strategies on The development of the logistics system and the supply chain of the country by formulating a strategic plan for the development of the logistics system of Thailand for the five-year medium-term plan as a framework for driving the development of a logistics system for successful implementation. Currently, the strategic plan is the third plan, defining the period from 2017 to 2021 under the twenty-year National Strategic Framework and the 12<sup>th</sup> National Economic and Social Development Plan (2017 - 2021) with the objectives of strengthening entrepreneurs, upgrading the efficiency of trade facilitation systems and the development of supporting factors. The way to drive the development of logistics upgrades will be cooperation between the relevant departments and the logistics development sector. Moving towards environmental logistics or green logistics is one of the strategies that Thailand should accelerate and encourage Thai entrepreneurs to prepare for developing the ability to manage the logistics system to achieve concrete results to create a competitive advantage that will increase in the future as well. For measures to prevent trade in various forms, we should manage the supply chain effectively by the new rules that get along with global environmental trends. Then the ASEAN region becomes a huge market that is attractive to investors around the world, including those ASEAN member countries from trade

and investment agreements to bring benefits to the economy of the region as a whole. Thailand itself should accelerate the development of capacity, especially in logistics to become a distribution center for ASEAN and the world. At present, each organization has managed and improved every step of the logistics process to minimize the impact on the environment by turning more attention to environmental responsibility (Office of the National Economic and Social Development Board 2016).

From the aforementioned, it is therefore very important to study whether we will lay down guidelines for green logistics management for the sustainable environmental quality of Thai palm oil mills in the future to create value and reduce transportation costs for palm oil. Researchers must find ways to develop appropriate environmental management. Therefore, the researcher has studied “the development of the Green Logistics Management Model for the sustainable environmental quality of Thailand’s palm oil mills in the future”. The results of the research can be used as guidelines to increase the efficiency of green logistics management of the palm oil industry of entrepreneurs in Thailand and result in increasing productivity, reducing costs in production, and operating under various related green logistics activities, including creating advantages in the next competition.

### **Research Objectives**

1. To study the green logistics management guidelines for the sustainable environmental quality of Thailand’s palm oil mills in the future.
2. To develop the green logistics management model for the sustainable environmental quality of Thailand’s palm oil mills in the future.

### **Expected Benefits**

1. Providing green logistics management guidelines for the sustainable environmental quality of Thailand’s palm oil mills in the future.
2. Obtaining the development of a logistics management model for the sustainable environmental quality of Thailand’s palm oil mills in the future.
3. Getting recommendations from research studies to develop a model of green logistics management for the sustainable environmental quality of Thailand’s palm oil mills in the future.

### **Methodology**

In this study, the researcher selected twenty-four experts using a purposive sampling method (Matthew B. Miles, A. Michael Huberman, & Johnny Saldana, 2014). The research’s tool was the EDFR interview conducted to interview a sample group of experts, and the interview was carried out in three rounds. In the first round, the researchers created an open questionnaire, and in the second round, the researcher synthesized the first round of interviews into issues by using the Raring Scale model, which has five levels, weighing the possibility of trends respectively. Scores are as follows:

- 1 means That trend is the least likely.
- 2 means The trend is likely to be less probable.
- 3 means The trend is moderately probable.
- 4 means The trend is very likely.
- 5 means That trend is the most probable.

Then the score obtained was calculated to find the Median, Mode, and interquartile range (IQR). The third round used the questionnaire from the second round to increase the median of the score rating scale of the interquartile range. Then, bring data that the group of experts has consistent and inconsistent opinions on both the term interquartile range and the difference between the Median and the Mode. Finally, the researcher summarizes the opinions of a group of experts.

### **Data Collection**

The researcher collected the data by visiting the research area. Before the interview, the researcher has clarified the interview both in written and verbal and ask for cooperation in participating in a voluntary research project.

### **Data Analysis**

The researcher used the data obtained from the questionnaire in the second round to analyze the median, mode, and interquartile ranges individually. Then choose a trend with a median, mode of 3.50 and above to create an interview form to collect data in the third round. After that, those data were analyzed by the median, mode, differences between mode and medians, and interquartile ranges for each interpretation. The researcher has defined it as follows (Jumphon Poonpatatcheewin, 1999).

1. Median
  - A median between 4.50-5.00 shows that experts see the statement as a chance that the trend will happen the most
  - A median between 3.50-4.49 shows that experts see the statement as likely to be trending.
  - A median between 250-3.49 shows that experts consider the statement a moderate chance that the trend will occur.
  - A median between 1.50-2.49 shows that experts see the statement as a chance that the trend will happen less
  - A median between 1.00-149 shows that the experts see the statement as a chance that the trend would least occur.
2. Interquartile Range

The researcher calculated the difference between the first quartile and the third quartile, the interquartile ranges were calculated under any trend is less than or equal to 1.50 indicating the opinion of the expert group on the trend are consensus. The interquartile ranges of a trend greater than 1.50 indicate that the opinions of experts on the trend are inconsistent.

### 3. Value Difference between Mode and Median

In the interpretation, the researcher determined that if the value of the difference between the mode and median exceeding 1.0 will indicate the opinions of the management and staff relating to the electricity-saving management of the research area towards the message are consistent.

### 4. Consistency Consideration

Any statements whose interquartile ranges do not exceed 1.50 and the difference between mode and median does not exceed 1.00 are consistent. In any case, the statements have interquartile ranges not more than 1.50, but the difference between mode and median exceeds 1.00 or vice versa, the statements are inconsistent.

## Data Analysis Results

**Table 1** Frequency values of social analysis in green logistics management system for the environmental quality of Thailand's palm oil mills in the future.

No.	Analysis of social conditions in the green management system Logistics for the Environmental Quality	Frequency
<b>The most probable form</b>		
1	To build a factory plan in a large palm plantation area.	12
2	The system for transferring the palm from the plant to the factory uses a conveyor belt.	12
3	Quality machines can succinct some steps out to be faster.	9
4	Providing a quality fertilizing system and systematic plant care.	8
5	Organize an effective palm-trimming system by sending gardeners to attend training.	8
6	Using more organic fertilizers and fewer chemical fertilizers for the greatest benefit in obtaining the available palm fruit quality and weight are quite good.	
7	Using human labor in the area requires precision to reduce the unemployment rate in the area.	7
8	Using leisure activities to exercise 15 minutes for the good health of employees.	4
9	The government provides funding to farmers for modern palm care pieces of equipment.	3
<b>Recommendations</b>		
1	There should be skilled workers in each specific area.	5
2	There should be hiring local staff for the local people to have jobs and help in taking care of resources in their company.	4

From Table 1, it found that the most probable forms are placing a factory plan in a large palm plantation area, and the system for transferring the palm from the plant to the factory uses a conveyor belt with the highest frequency of 12, followed by Quality machines that can succinct some steps out to be faster with a frequency of 9. Providing a quality fertilizing system and systematic plant care and organizing an effective palm-trimming system by sending gardeners to attend training with the frequency of 8. Using more organic fertilizers and fewer chemical fertilizers for the greatest benefit in obtaining the available palm fruit quality and weight are quite good with a frequency of 7. Using human labor in the area requires precision to reduce the unemployment rate in the area with a frequency of 4. Using leisure activities to exercise 15 minutes for the good health of employees with a frequency of 3 and the government provides funding to farmers for modern palm care pieces of equipment with a frequency of 1. In the recommendations, it was found that there should be skilled workers in each specific area with the most frequencies of 5, followed by hiring local staff for the local people to have jobs and help in taking care of resources in their company with a frequency of 4.

**Table 2.** The frequency values of logistics management efficiency.

No.	The efficiency of logistics management	Frequency
<b>Transportation management</b>		
1	Transportation of crude palm to the factory by various types of trucks and transporting palm oil ready for sale by which the company is the supplier of goods to various groups of merchants or sub-merchants to pick up by themselves	13
2	Using a powerful car that is not too old.	7
3	Using the standard import-export company, in the case of exporting products for sale abroad.	7
4	Studying the most economical means of transportation.	7

From Table 2 on transportation management, it found that the transportation of crude palm to the factory by various types of trucks and transporting palm oil ready for sale by which the company is the supplier of goods to various groups of merchants or sub-merchants to pick up by themselves with the highest frequency of 13, followed by using a powerful car that is not too old, using the standard import-export company, in the case of exporting products for sale abroad, and studying the most economical means of transportation with a frequency of 7.

**Table 3** Green Logistics frequency values, dimensions of adaptable management to green logistics based on corporate social responsibility concept for logistics management in related dimensions with the environment.

No.	Dimensions of adaptable management to green logistics based on corporate social responsibility concept for logistics management in related dimensions with the environment	Frequency
<b>Cost reduction in logistics</b>		
1	Using a conveyor belt system instead of transporting with trucks because it causes pollution.	16
2	Using conveyor systems instead of forklifts or backhoes that require diesel fuel to drive machinery because it causes air pollution.	13
3	Wastewater treatment before releasing it into rivers and canals.	9
4	Using standard machines.	9
5	Establish a factory in a large palm plantation.	5
<b>Improvement of the organization image</b>		
1	Using the CSR system to return profits to the society in the area, such as planting mangrove forests to help poor villagers, and providing scholarships to poor children or orphans	25
2	Hiring local people to be employees so that people in the area would have jobs.	6
<b>Responding to the needs of customers</b>		
1	Having fast service.	18
2	Having good manners and speaking well.	18
3	Continuing the service of employees regularly and impressing customers.	16
4	Listening to the opinions of customers and brought into the improvement process.	6
<b>Improvement of profits</b>		
1	Giving dividends to shareholders annually.	16
2	Taking staff to travel to other provinces to strengthen relationships.	13
3	There is an annual bonus when sales reach the target.	11
4	A portion of profits is given back to society through CSR.	8
5	Entrepreneurs don't look for too many profits but all parties can survive.	6
6	Profits received will be dividends to the shareholders that can create encouragement for the group of shareholders.	2
<b>Creation of competitive advantages</b>		
1	Product quality must be of the same standard every round.	14
2	Building a brand to be recognized.	12
<b>Dimensions of adaptable management to green logistics based on corporate social responsibility concept for logistics management in related dimensions with the environment</b>		
3	Reducing the loss during production.	9
4	The production volume must be ready to meet the market demand, especially in the area.	8
5	Using a variety of management strategies.	8
6	Using modern machines.	7
7	Palm pulp can be further produced as fuel briquettes.	5
<b>Reducing environmental impact</b>		
1	Wastewater treatment before discharge into the river.	22
2	Reducing the use of machines that use diesel fuel but changed to electricity conveyor belts instead.	21
3	Planting mangrove forests in the area.	6
<b>Optimizing logistics flow</b>		
1	Shortening each step of the process and being more efficient.	12
2	Encouraging the establishment of extraction factories in large palm plantations.	12
3	Developing personnel to be effective in their responsibility.	11
4	Using standard trucks.	10
5	Supporting the use of conveyor belts.	9
6	Using the transport of the agency by the government in the case of export.	6

From table 3, dimensions of the adaptable management to green logistics based on the corporate social responsibility concept for logistics management in related dimensions with the environment can be divided into each aspect, namely, for cost reduction in logistics, it found that the use of a conveyor belt system instead of transporting with trucks because it causes pollution with the highest frequency of 16, followed by the use of conveyor systems instead of forklifts or backhoes that require diesel fuel to drive machinery because it causes air pollution with the frequency of 13. Wastewater treatment before releasing it into rivers and canals and using standard machines with the same frequency of 9. Establishment of a factory in a large palm plantation with a frequency of 5.

For improving the image of the organization, it was found that the use of the CSR system to return profits to the society in the area with the highest frequency of 25, followed by hiring local people to be employees so that people in the area would have jobs with a frequency value of 6.

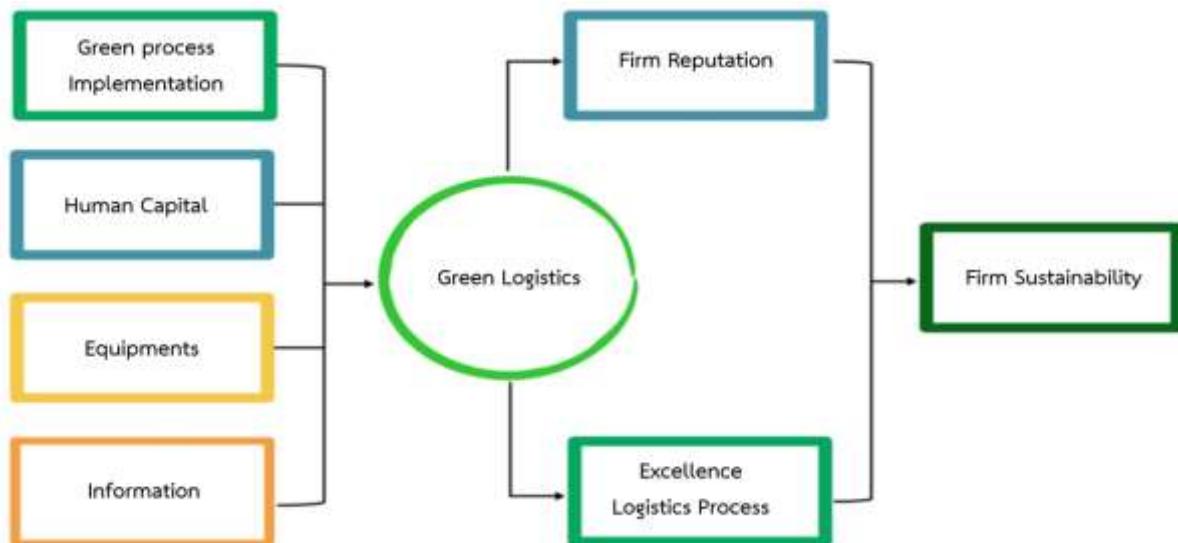
For responding to customer needs, it was found that having fast service, having good manners, and speaking well with the same highest frequency value of 18, followed by continuing the service of employees regularly and impress customers with a frequency of 16. Listen to the opinions of customers and brought into the improvement process with a frequency of 6.

For improving profits, it was found that dividends were given to shareholders annually with the highest frequency of 16, followed by taking staff to travel to other provinces to strengthen relationships with a frequency of 13. There is an annual bonus when sales reach the target with a frequency of 11, a portion of profits is given back to society through CSR with a frequency of 8. Entrepreneurs don't look for too many profits but all parties can survive with a frequency of 6. Profits received will be dividends to the shareholders that can create encouragement for the group of shareholders with a frequency of 2.

For creating the competitive advantages, it was found that the product quality must be of the same standard every round with the highest frequency value of 14, followed by creating a brand to be remembered with a frequency of 12 and reducing losses during production with a frequency of 9. The production volume must be ready to meet the market demand, especially in the area, and the use a variety of management strategies with the same frequency of 8. The use of modern machines with the frequency of 7 and palm pulp can be further produced as fuel briquettes with the frequency of 5.

For reducing environmental impact, it was found that wastewater was treated before discharge into the river with the highest frequency of 22, followed by reducing the use of machines that use diesel fuel but changed to electricity conveyor belts instead with the frequency of 21, and planting mangrove forests in the area with a frequency of 6.

For optimizing the logistics flow, it was found that the process was developed in each step to be shorter and more efficient and encouraging the establishment of a large palm extraction plant with the same highest frequency of 12, followed by personnel development to be effective in their responsibility with a frequency of 11, using standard trucks with a frequency of 10, supporting the use of conveyor belts with the frequency of 9, and using the transportation of the agency by the government in the case of export with a frequency of 6.



**Figure 1:** Development of Green Logistics Management Model for the Sustainable Environmental Quality of Thailand's Palm oil Mills in the Future

From Figure 1, the development of the green logistics management model for the sustainable environmental quality of Thailand's palm oil mills in the future can indicate that the development of the green logistics management model for the sustainable environmental quality of Thailand's palm oil mills in the future has a green logistics management development model. There are important issues of the concept, activities, and factors that result in green logistics management, consisting of four aspects, namely, the first aspect, the green process implementation has the management of green logistics in the industry which is the concept of the logistics management process of environmental friendliness. In the second aspect, human capital management is related to the process of work of employees in the industry to systematize regulations in the work of employees in each department. In addition, human capital management has technical concepts in human resource management, which means the concept of focusing on knowledge of behavioral sciences that be able to manage various activities with techniques. In the third aspect, pieces of equipment: management of the organization caused by working by the goals to produce results that affect the environment in a better way by choosing equipment and industrial materials to lead the way to achieve the goals set forth. In the fourth aspect, information: management of information and knowledge is to improve the organizations build systems that are readily available for all important users. These systems have been updated, built confidence and trust in customer service. Organizations use communication devices to contact employees for the convenience of communication. These four factors resulted in the Green Logistics Management are the important aspects of logistics management related to the environment that will affect global warming change including environmental impact caused by various activities related to the excellence logistics process. Moreover, these four factors can build

the reputation of the firm and make the company or organization more accepted, which can create an image for the organization and teach important parts that promote firm sustainability.

## Discussion

The research on “Development of the green logistics management model for the sustainable environmental quality of Thailand’s palm oil mills in the future” has analyzed the data to study management guidelines of the Green Logistics for Sustainable Environmental Quality of Thailand’s Palm Oil Mills. The study was consistent with the concept of measuring efficiency in supply chains. James A. Reeds, Whitfeld Diffie J. V. Field (2015) states that defining elements of transportation management by the context of the business. In this research, there are transportation management and reduction costs to increase work efficiency. The organization must set the first goal that good transportation management must reduce the cost of the organization, thereby reducing the turnaround time to improve the management system by adopting suitable technology for the organization to help bring benefits and various values. This is consistent with what has been studied from the review literature on “Reducing reproduction costs in a step-by-step manufacturing process by solving quality constraints”, by David de-Felipe and Ernest Beuscito (2017). This research offers a model of multiple responsive optimizations (MRO). A two-step manufacturing process of this model provides a limit and quality requirements. This model was evaluated by comparison of production capacity and cost for the reproduction, the process before and after optimization, and is consistent with the concept of Green logistics for sustainable development that has been studied by Suwannee Asavakulchai (2008). Logistics Management is an optimization process for the delivery of goods from the manufacturer to the consumer and helps to increase the capabilities of the business sector and industry in terms of cost reduction, production, added value, energy-saving, and environmental protection go hand in hand. But in reality, reducing logistics costs can lead to a reduction in impact on the environment. Green logistics is the activity or process of moving goods and information from upstream to downstream and back from the customer to the beginning by reducing the use of energy and natural resources, minimal emissions. In addition, it has begun to play a role in the production process, trading, transportation, and delivery of products while maintaining efficiency and overall effectiveness.

The research on “Development of the green logistics management model for the sustainable environmental quality of Thailand’s palm oil mills in the future” has analyzed the data to study management guidelines of the Green Logistics for Sustainable Environmental Quality of Thailand’s Palm Oil Mills. Green logistics management consists of four aspects as follow:

1. The Green Process Implementation: Management of Green logistics and supply chain processes is one of the important factors to increase competitive efficiency to the business or industry. Adopting the process management approach applied with green logistics management in the industry is considered as one of the factors that can help reduce costs and increase the level of ability to meet customer needs in terms of time, quality, and increase competitiveness to a business or industry goes well. As a result, the current management of logistics and supply chain processes has a very important role on the global stage. However, the current logistics and supply chain management has continuously developed style and management in many dimensions such as management dimensions to manage costs, management dimensions to meet customer needs, environmentally-friendly management dimensions (Green Logistics and Supply Chain Management), especially the management dimensions that are environmental friendliness. It is a business development approach that has received attention both at the corporate or business level and at the industrial level as well as at the national level. Furthermore, it focuses on the development and improvement of operations in logistics activities with taking into account the environment in every activity at the same time since the procurement of raw materials to the production process, basic raw materials processing, production process, inventory management, freight forwarding to customers, and customer management by delivering the right product on time and the desired place. It is by Mano Prachayapipat (2019), which has studied “the supply chain management of crude palm oil mill operators”. It was found that logistics management is part of the supply chain management system to minimize the cost of the entire system and still respond to the service level that customers want by upgrading the value chain of oil palm. Logistics management has been developed as follows: 1) products by optimizing oil palm fruit production 2) Process upgrading by applying modern technology in various processes with research and development to keep up with changes in technology that are changing rapidly. Kittipong Tissayakom and Fumio Akagi (2014) studied “Green Logistics Management and Performance of Logistics Companies in Thailand”. They studied the environmental management system of logistics companies in Thailand and develop the concept of Green Logistics. Logistics activities include transportation, storage, inventory management, material handling, and disciplined processing of all data which is consistent with Kanwaji Tharachot-Rungsatid (2014) who study “Efficiency and Effectiveness of Logistics to Transport Thai Rice in Transport Route from Nakhon Sawan Province to export abroad”. It was found that the efficiency and effectiveness of the logistics of goods transported in different forms, for example, the form of logistics transported by road. In terms of vehicles used in road transport, there are trucks which are classified as fast transport services. The speed lies in the vehicles that can travel at high speeds, so it takes less time to fill the entire truck including loading and unloading goods in the truck and out of the truck takes less time. The speed of transportation reduces the transit cycle time. This reduces inventories and reduces the loss caused by deteriorated materials including outdated products. However, transportation by truck can also travel along the main road, small roads, or even no roads if there are no obstacles or obstacles beyond truck capacity. Therefore, trucks can travel to different locations for loading and unloading products better than other modes of transport, can reduce damage during transportation, can promote the organizing process, and can freight and distribute products promptly that customers need. Trucks can also help reduce unnecessary costs in the process, can help to improve the system, and can continue to create better customer satisfaction.

2. Human capital or human resource is considered as one of the most important resources and the driving force of the organization. Human capital consists of accumulated skills, knowledge, expertise, experience, creativity as well as personality, and other intangible personal assets such as personal relationships in social acceptance to make that person can create economic value for oneself, the organization, and society. It can also be used in operations, by Muma et al. (2014) who study “Green supply chain

management and environmental performance". It showed a positive correlation with green supply chain management and business performance, and also found a correlation with social performance.

Waight, Celina F, and Bath, Alistair J. (2014) investigated "Factors Influencing Attitudes Among All-Terrain Vehicle Users on the Island Portion of the Province of Newfoundland and Labrador, Canada. Journal of Outdoor Recreation and Tourism". They assessed the attitudes of vehicle users in all terrestrial areas towards the impact of environmental beliefs and the social impact of the activities' social influence, social situation, and demography. Grimmer, Martin and Bingham, Timothy (2013) studied "Company Environmental Performance and Consumer Purchase Intentions". For products from organizations that have been seen as having high environmental performance compared to an organization that has been recognized for its environmental performance. It can be seen that consumers tend to like organizations with higher environmental performance than those with low environmental performance, even though they are distributed through agents. This is to provide quality service, same standard, and accepted of consumer, organizations should have training for employees and personnel for the development of human capital to have potential ready for operation and create awareness for employees to be responsible for the work in each department. Weerawat Maneesuwan and Thananya Wasusri, (2014), studied "Green Logistics Management and Service Provider Potential Thai Logistics". It showed the potential of logistics service providers and factors that drive people to provide logistics services adapting to green logistics management as well as problems and obstacles that affect green logistics by analyzing the logistics potential in four dimensions. It comprises the organization's strategy, planning, operation, and environment. It can be seen that logistics service providers still lack personnel with the knowledge and lack of adequate and continuous understanding of logistics management, which the government should play a role in promoting knowledge on green logistics management for personnel to have good and sustainable management.

3. Pieces of equipment: Management of a business is required to select tools for quality management and is accepted according to international standards. The management of the organization is necessary to plan the implementation to meet the goals, to achieve results that meet the goals set, and affect the environment in a better way by choosing equipment and industrial materials to lead to achieve set goals such as the selection of machinery, packaging, and standardized palm oil extraction machines, quality transport, etc. These tools are the drivers of environmentally friendly palm oil output. It is relevant with the research of Yingshun Liu, Shilion Yu Xiandeng Liang, and Tangyi Guo (2011) who study "System dynamics model for structure configuration of the transportation corridor". It showed the structure of the walkway in aerodynamic transport and shows that the system model is qualified for the efficient addition of the structure of transport corridors. The same applies to the use of Palm conveying machinery to the truck for transporting the goods quickly and more efficiently. However, the use of tools helps to reduce errors that may be caused by humans or operators, and bringing tools in the transportation can reduce the wages of workers in transporting palm or palm oil. It is consistent with Pichai Liaorueangrat, (2015), who study "Green Logistics for Sustainable Development". It showed that global warming and the deterioration of the current environment are important issues of concern around the world due to the impact on the environment such as air pollution caused by transportation, energy use in the production process, and the use of packaging materials. Logistics management is the process of optimizing the management of the delivery of goods from the manufacturer to the consumer and helps increase capacity for the business sector and industry in terms of reducing production costs, creating added value, saving energy, and protecting the environment at the same time. In this regard, the industry should have a plan to choose quality tools and be environmentally friendly but still maintain good efficiency and effectiveness to help the industry achieve its goals and increase the competitiveness of the business.

4. Information: Management of information and knowledge is to improve the way organizations create a system that the information is available to all critical users, including administrators, personnel, other organizations, or organizations that work with clients and stakeholders. Pichai Liaorueangrat, (2015), studied "Green Logistics for Sustainable Development". Global warming and the deterioration of the current environment are important issues of global attention due to causing environmental impacts such as air pollution caused by transportation. Logistics management is an additional efficient process, management, shipping from the manufacturer to the consumer and increase the capacity of business and industry. Therefore, the transportation should be modernized using a location tracking device to transport logistics check to be used for decision-making, to be able to control, monitor, direct and correct the situation promptly. It also helps in the matter of correct and timely transportation of goods. Moreover, it can control the use of the route, tell customers where the car is and when, reduce the advance wages for employees, increase the safety of transportation, which is serious damage, or loss of property and reputation. In addition, it helps to control the driving, not to drive fast, excessive or dangerous driving behavior. It can also help build confidence and trust in customer service. The use of communication devices to contact employees to facilitate communication is consistent with Kittipong Tissayakorn and Fumio Akagi (2014) who study "Green logistics management and performance for Thailand's logistic enterprises". It showed the development of the concept of Green Logistics that includes transportation, storage, inventory management, material handling, and processing all data to meet the needs and accessible in the form that the user wants. The management of information and information must be accurate, complete, timely, safe, and have a confidentiality system and the reliability of the information. Organizations must establish a system of rapid-learning exchange within the organization to improve efficiency, organizational effectiveness, and innovation. The process can be carried out by the organization using knowledge management tools which is the collection of knowledge that exists in organizations scattered among individuals or documents to develop into a system. Then employees or data users can access quickly and comprehensively to information. MapReduce productivity measurement models and measurement methods by studying the utilization of computer resources are efficiently reliable and secure of information to encourage employees to access information, knowledge and be able to develop themselves to be knowledgeable. Finally, there is an exchange of knowledge and experience, effective operations, and more effective.

## Recommendations

1. In the hauling of crude palm in the factory should use a belt to help convey because it will reduce the pressure of soil in the palm plantation from the size of a truck.

2. The results of this study are used to support entrepreneurs in giving knowledge and understanding preliminary to realize social and environmental responsibility.
3. It is mixed research aiming to study the current conditions to study the problem condition and propose guidelines for future development which still lacks participation and concrete development. Therefore, in the next research, the researcher should design the research for participative development and emphasize more practice.
4. From the needs of those involved in the development of green logistics management for the sustainable environmental quality of palm oil mills in this research, the next research should be done on the issues of innovative development.
5. For the implementation, the involved people, companies, government etc. can apply the results of the data analysis as a guideline for the development of logic systems to create a new model to suit each region.

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