Green logistics management model for environmental sustainability of tire manufacturing industry in international market

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Abstract

In this section 1. To analyze the situation of the export market tire industry 2. To study the management of green logistics for the environment sustainability of the tire manufacturing industry in the export market and 3. To develop a model of green logistics management for the environment sustainability of the tire manufacturing industry in the export market. The research is a clear sample survey method, including export tire manufacturers in the export market. Again, 121 major sources of information, 6 metals, most of the research did not collect data and interviews and descriptive statistics in the analysis of the research data found that From the beginning, all entrepreneurs found that entrepreneurs often noticed that there was a period of operation of 10-15 years. The establishment received ISO 18000 standards and mostly produced and exported personal tires.

The results mentioned the situation of the level of opinions on Green logistics, the tire manufacturing structure had a lot of opinions ($\bar{x}$= 4.02, S.D. = 0.65). The technology factor can be examined. The level of opinions on the time dimension In communication, there are many opinions on feelings ($\bar{x}$= 4.11, S.D. = 0.62). Attitudes on reliability found that the level of opinions on the dimensions of reliability had many opinions ($\bar{x}$= 4.01, S.D. = 0.72). The mind on cost management found that the level of opinions on the dimensions of cost management had many opinions ($\bar{x}$= 4.08, S.D. = 0.72). And various dimensions often found that the level of opinions on various dimensions had many opinions ($\bar{x}$= 4.10, S.D. = 0.70) on

Examine the management model of green logistics for a sustainable environment of tire production in the export market. Find industry groups that have improved logistics systems. Carbon dioxide emissions are a result of its flow in direct transportation of goods. Many different transportation systems will help you move ... ay store or transport raw materials Display or product remains by selecting a transportation or transport mode, reducing vehicle underloading and empty runs or using Milk Run transportation to help reduce the total cost of technology at the inventory level and comply with national environmental laws and sustainable environmental management for the benefit of society..

Keywords: Automotive rubber industry , Green logistics management, develop a sustainable

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1. Introduction

From the current situation, the adjustment of the economic and social development model based on the country's strength in terms of high-value products and services that are upgraded in the production chain of products and services is very important to drive the country's economy. In addition, modern digital innovation technology can further develop and create sustainable economic growth, including the distribution of income and wealth inclusively (Inclusive Growth). The use of the new economic model called "BCG Model" is the development of 3 economies: Bio-Economy, Circular Economy, and Green Economy to drive the country forward in a tangible way, especially the concept of the circular economy system that emphasizes the efficiency of waste management from production and consumption by reusing raw materials that have been produced and consumed into the production process (Re-Material) and supporting reuse (Reuse), including changing the business model from production to services that use technology to use resources only as necessary and with maximum efficiency, including the development of innovative product designs from environmentally friendly raw materials or products with a long shelf life, as well as adding value to waste from the production process. However, many organizations have begun to place more importance on sustainable development and the environment because the concept of the circular economy shows a change in business operations that integrates economic and environmental activities. It is also related to the supply chain management approach that can create sustainable cross-industry networks. By using resources according to the 3Rs strategy: Recycle, Reduce and Reuse, and applying it in various industries such as the automotive parts industry, textile industry, iron and metal manufacturing industry, etc. (Industrial Development Plan, 2022)

In the industrial sector, such as the manufacturing and export industry, such as the automobile manufacturing industry, from the overall tire production volume in February 2023 compared to February 2022 (estimated data from a survey of operators by the Office of Industrial Economics), divided by product, the details are as follows: Car tires shrank by 3.21 percent. Truck and bus tires shrank by 11.11 percent. Motorcycle tires shrank by 13.79 percent. Other tires shrank by 25.55 percent. Truck and bus inner tubes shrank by 33.92 percent. Motorcycle inner tubes shrank by 14.39 percent. For the overall production volume of medical rubber gloves in February 2023, it was 2,299 million pieces (estimated from data obtained from a survey of operators by the Office of Industrial Economics), which was a decrease when compared to February 2022, which had a production volume of 2,630 million pieces, or 12.59 percent. Trade and market conditions Domestic sales Overview of domestic tire sales in February 2023 (estimated from data obtained from a survey Entrepreneurs of the Office of Industrial Economics) compared to February 2022, divided by product, the details are as follows: passenger car tires shrank by 7.38 percent, truck and bus tires shrank by 18.94 percent, tires, etc., have increased gradually due to quality control and protection under the requirements of green logistics, resulting in compliance with the specified conditions. And what entrepreneurs give great importance to is the production process, the raw material procurement process that must be under the control of the Chinese market. And importantly, the production process must not be toxic to society. In addition to the situation of the Chinese tire industry in the past 1-2 years, it has been affected by the spread of COVID-19 and the global macroeconomic slowdown, causing the demand for tires in the market to slow down as well. However, the Chinese new energy vehicle market has begun to show a bright direction in terms of production and sales volume, which have continuously expanded. In addition, the

government's policies to support consumption recovery have made the Chinese tire market, which is part of the industrial chain, still have the opportunity to grow continuously. In particular, Thailand, a country that produces natural rubber, which is the main raw material for producing automobile tires, will continue to have opportunities to continuously export rubber to China as well. This is because the Chinese market still has a lot of demand, which is consistent with data on the increasing demand for automobile ownership in China. The latest data as of March 2022 showed that automobile ownership in China was 307 million units, an increase of 1.66 percent compared to the end of 2021. It is also predicted that after 2023, the factors limiting the Chinese automobile tire market will improve and there will be more purchase orders from abroad, as well as domestic demand that tends to recover more. Therefore, Thai natural rubber will still be a good target raw material for importing to the Chinese market in the future. However, Thai entrepreneurs still need to closely monitor the situation of automobile tires in China and the demand for natural rubber as a raw material for producing automobile tires, as the patterns and demands in the Chinese market are always changing. This is so that Thai entrepreneurs can plan production, manage warehouses, and distribute appropriately. In order not to be a trade obstacle for the export of natural rubber from Thailand in the future (Office of International Trade Promotion in Qingdao, 2022)

From the above information, the researcher sees the importance of green logistics management in the tire manufacturing industry. The researcher studied from the place that has a demand for tires. It is an area with a high demand for services and importantly, it is a route that controls costs for entrepreneurs. In terms of green logistics management, it is an adjustment that the industry group should give importance to along with the dimensions of transportation time, reliability, cost management, and environmental dimensions. All of these are logistics processes that can be applied throughout the supply chain.

1.1 **Research Objective**

1.1.1 To analyze the situation of the export market tire industry

1.1.2 To study the management of green logistics for the environment sustainability of the tire manufacturing industry in the export market and

1.1.2 To develop a model of green logistics management for the environment sustainability of the tire manufacturing industry in the export market.

2. Literature Review

Waiyawuththanapoom P. (2024). said the effect of green supply chain management practices on performances of herf manufacturers in Thailand aimed to 1) investigate the levels of green supply chain management practices (GSCMP), environmental performance (ENP), operational performance (OPP), and organizational performance (ORP) in the context of Thai herb producers; and 2) investigate the interactions between GSCMP, ENP, OPP, and ORP. Quantitative research methodologies were applied in the research. The sample for the quantitative study consisted of 340 Thai herb producers selected by stratified sampling by region. The instruments employed for research were questionnaires. Statistics such as frequency, percentage, mean, standard deviation, confirmatory factor analysis, and structural equation modeling were utilized for quantitative data analysis. Results indicated that GSCMP, ENP, OPP, and ORP levels were high. In addition, GSCMP had direct positive effects on ENP and OPP, as well as indirect positive effects on OPP and ORP, respectively, mediated

via ENP and OPP. In addition, ENP had a favorable direct impact on OPP and a positive indirect impact on ORP, with OPP serving as a mediator. Herb producers might use these insights as a roadmap to enhance their organizational performance. In addition, government agencies may utilize the study's findings to establish a strategy for assisting entrepreneurs. In addition, academics and interested parties might bring the research findings to examine and perform more research.

3. Methods

3.1 Quantitative research

This research studied both qualitative and quantitative studies. In the quantitative study, the sample consisted of 121 tire exporters (Thai Rubber Exporters Association, 2022). The researcher selected those with at least 7 years of experience in tire export production and collected the full number because this sample group had the production and transportation of tires in the market to access the operation process that was consistent with the context of this research study. Purposive sampling was used.

3.1 Qualitative

In the qualitative study, the researcher selected key informants by purposive sampling to conduct in-depth interviews with 6 key informants. The criteria for selecting participants for in-depth interviews were as follows:

1. Representatives from government agencies must have experience in various operations related to sustainable green logistics management and product export for no less than 7 years.

2. The Rubber Association of Thailand must have experience in importing and exporting tires for no less than 7 years.

The research instruments were questionnaires and interviews, with primary and secondary data collected. In addition, descriptive data analysis and content analysis were conducted.

4. Results and Discussion

Quantitative analysis results From the survey of basic information of 121 respondents from all entrepreneurs, it was found that most entrepreneurs were established as limited companies, 87 of which were 71.90 percent, followed by limited partnerships, 34 of which were 28.10 percent, respectively.

The operation period was 10-15 years, 51 of which were 42.14 percent. The establishments received ISO 18000 group standards, 35 of which were 28.92 percent. The product groups that were produced and exported were mostly passenger vehicle tires, 25 of which were 20.66 percent.

The analysis results according to objective 1 found that the analysis of data on Green logistics in the tire manufacturing industry found that the level of opinions about Green logistics in the tire manufacturing industry There was a high level of opinion ($\bar{x}$ = 4.02, S.D. = 0.65). When considering each item, it was found that there was a high level of opinion in every item, namely, the organization reduces the transportation of empty vehicles and always loads the goods to prevent wasteful fuel use, which had the highest level of opinion ($\bar{x}$ = 4.16, S.D. = 0.57). The lowest level was, the organization reuses the remaining rubber from the first

production to reduce costs in the second production, which had a high level of opinion ($\bar{x}$ = 3.87, S.D. = 0.71).

The analysis of data on the transportation time dimension found that the level of opinion on the transportation time dimension was at a high level ($\bar{x}$ = 4.11, S.D. = 0.62). When considering each item, it was found that there was a high level of opinion in every item, namely, the organization has a quality transportation and transportation system that is environmentally friendly. The opinions were at a high level ($\bar{x}$ = 4.15, S.D. = 0.59) the most and the least were that the organization transported by truck, transported, moved and used additional equipment (scooped and lifted) for speed, with a high level of opinions ($\bar{x}$ = 3.95, S.D. = 0.69).

Data analysis on the reliability dimension found that the opinions on the reliability dimension were at a high level ($\bar{x}$ = 4.01, S.D. = 0.72). When considering each item, it was found that all items had a high level of opinions, such as that the organization had a clear production schedule according to the steps, with a high level of opinions ($\bar{x}$ = 4.19, S.D. = 0.61) the most and the least was that the organization could replace damaged or lost products, with a high level of opinions ($\bar{x}$ = 3.92, S.D. = 0.73), respectively.

Data analysis on the cost management dimension found that the opinions on the cost management dimension were at a high level. There were opinions at a high level ($\bar{x}$ = 4.08, S.D. = 0.72). When considering each item, it was found that there were opinions at a high level in all items, namely, the organization has managed costs from activities in the warehouse and can select transportation locations that are appropriate for the Chinese market, with the highest opinions ($\bar{x}$ = 4.14, S.D. = 0.72). The lowest aspect was that the organization can determine the appropriate amount of inventory, resulting in the lowest storage costs, with the highest opinions ($\bar{x}$ = 4.00, S.D. = 0.82), respectively. Analysis of data on the environmental dimension found that the opinions on the environmental dimension were at a high level ($\bar{x}$ = 4.10, S.D. = 0.70). When considering each item, it was found that there were the highest opinions on 2 items, namely, the organization has tire products certified according to the industrial product standard, TIS 367, tires or international standards or national standards that are accepted. The opinions were at a high level ($\bar{x}$ = 4.24, S.D. = 0.68) and the least at the following aspects: and the organization has appropriate transportation network connections, reducing distance and reducing traffic density in the city and in important areas, with opinions at a high level ($\bar{x}$ = 4.02, S.D. = 0.73), respectively.

4.1 Qualitative analysis results

The analysis results according to objective 2 found that China's "Logistics System" is considered to have an advanced transportation system with modern transportation technology and has developed very far. Because China is a large country, it has advantages in terms of geography and the industrial system in China, which has established factories that produce and export goods all over the world. In terms of transportation and logistics in China, it is an important matter and has been supported by the Chinese government, which has seen the need to increase the efficiency of the transportation and logistics system in China for exporting goods, for the development of the transportation industry and logistics business, which has led to China's rapid development. By emphasizing the development of transportation and logistics businesses, China has developed into a country that is considered to be one of the world's top transportation service providers, resulting in the continuous expansion of the transportation service business in line with the development and the policy of creating basic public utilities

of the Chinese government, which helps make transportation and all forms of transportation more convenient and ready to provide services and are more complete, whether in terms of the storage system, transportation management system, information technology, tools and economic networks. From the advancement of the transportation industry and the development of public utilities, it has led to the development of more modern technologies for use in the transportation system to create convenience and modernity for transportation on land, water and air. There is an example of the expansion of the railway system in order to increase the volume of railway transportation more than before. This is an example of the Chinese government's policy for developing the transportation system. In addition, the Chinese government also has a policy to improve and organize transportation taxes and customs checkpoints to facilitate transportation and reduce the complexity of transportation business. This tax policy adjustment has an effect on the incentives of companies doing transportation and logistics business from local government policies to be in line with the government's main policy of promoting exports. Therefore, companies must be aware and adapt to changes in government policies and tax collection to create an understanding of doing business in line with government policies. This is one reason why the Thai manufacturing industry must develop and use a complete management model to keep up with the modern world.

5. Conclusion

The analysis results according to objective 1 found that the analysis results of data on Green logistics in the tire manufacturing industry found that the level of opinions on Green logistics in the tire manufacturing industry was at a high level ($\bar{x}$ = 4.02, S.D. = 0.65). The transportation time dimension had a high level of opinions ($\bar{x}$ = 4.11, S.D. = 0.62). The reliability dimension found that the level of opinions on the reliability dimension was at a high level ($\bar{x}$ = 4.01, S.D. = 0.72). The cost management dimension found that the level of opinions on the cost management dimension was at a high level ($\bar{x}$ = 4.08, S.D. = 0.72). The environment dimension found that the level of opinions on the environment dimension was at a high level ($\bar{x}$ = 4.10, S.D. = 0.70). From the preliminary analysis, the industry group mostly emphasized green logistics because the management must go through the process and supporting documents before entering the Chinese market. However, other aspects are still normal and can be controlled and corrected. This is consistent with the research of Bo Zhou (2022) studying the role of green logistics management in improving the sustainability performance of SMEs: Are economic practices and supply chain traceability important? The results found that sustainability is widely recognized as a pervasive phenomenon in business operations and performance. The Impact of Green Logistics Management on Business Sustainability Performance It was found that the relationship between green logistics management and corporate sustainability performance is mediated through circular economy practices. Direct and indirect analysis can be performed. The impact of green logistics management on corporate sustainability performance with circular economy practices Using the natural resource perspective and resource dependence theory as theories, the moderating effect of supply chain traceability on the association is also assessed. From empirical data from 211 small and medium-sized enterprises, SMEs, manufacturers in Bangladesh, the PLS-SEM technique is used to evaluate the hypotheses. The results show that green logistics has a positive effect on circular economy practices and corporate sustainability. In addition, supply chain traceability has a significant impact on SMEs' compliance with circular economy

practices. This is due to the failure to moderate the link between green logistics and sustainability performance. Economic practices are a mediator between SMEs' green logistics management and sustainability. By testing Sobel to analyze the data again, it was found that the natural resource perspective and resource dependence theory are ready to improve and create understanding of green logistics management, circular economy practices and sustainable operations for further performance evaluation.

This is consistent with environmental and resource management to reduce the impact of logistics operations. The results of this study can be used as a guideline for entrepreneurs to be aware and control both production and export according to the standards set by the Chinese market.

The analysis results according to objective 2 found that China's "Logistics System" is considered to be an advanced transportation system with modern transportation technology and has developed very far. The industrial system in China has established factories that produce and export goods worldwide. In addition, the Chinese government promotes green logistics management of the manufacturing industry to protect the environment sustainably under the requirements of CSR. Because in this situation, the Ministry of Industry has initiated the project to promote and develop establishments into green industries or the Green Industry project again under the World Strategy and Trade Plan since 2017 onwards. The goal is to develop industries for the environment and society proactively. Therefore, it has a mission to promote and develop establishments into green industries. It focuses on creating awareness for personnel at all levels to have knowledge and understanding of sustainable development. The project has set five levels of standards: Level 1: Green Commitment; Level 2: Green Activity; Level 3: Green System; Level 4: Green Culture; and Level 5: Green Network. From the analysis by the informants, it was found that green logistics management in the tire manufacturing industry for export to the Chinese market still emphasizes supporting environmental protection. Because the impacts if the measures are not complied with, China will no longer be able to accept goods from abroad. This is consistent with the research of Azhar Ahmad (2022) studying the Impact of Green Supply Chain Management Practices on Sustainability Performance. The study found that the increasing environmental challenges, the strength of stakeholders, and the sustainable performance of companies measure not only economic performance but also sustainable development. Since the environmental supply chain management of companies plays an important role in driving sustainable operations, this study focuses on assessing the impact of green supply chain management practices on the sustainable performance of the textile, automotive, and tobacco industries. The data were collected from 384 organizations and analyzed using SPSS and AMOS. The results found that the impact of green production, green purchasing, green design and information systems.

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