The Reverse Logistics Processing Development of Auto parts Industries in Thailand

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Abstract

This study's objectives were; 1) to study the reverse logistics processing development of auto parts industries in Thailand, 2) to develop a model of the reverse logistics processing development of auto parts industries in Thailand. The unit of analysis is the auto parts industries in Thailand. The questionnaire-based survey applied to a sample of 368 auto parts industries in Thailand from tier-1 auto parts makers, tier-2 auto parts makers, and tier-3 auto parts makers using a multinomial logit model. The statistics were to identify factor with confirmatory factor analysis; one-way ANOVA used to define different factors and relative factors affecting the reverse logistics processing development of auto parts industries in Thailand that can predict the results using multinomial logit modeling for predicting choice behavior of the reverse logistics processing development of auto parts industries in Thailand.

The results revealed that: 1) the factors affect the reverse logistics processing development of auto parts industries in Thailand. The nine elements are recovery accumulating, warehouse management, green operating, transportation, internal reverse logistics, economics operating, environmental awareness, cooperation in reverse logistics, and reverse logistics management systems. 2) The tier-1 auto parts maker has reverse logistics processing development, the second is the tier-2 auto parts maker, and the third is the tier-3 auto parts maker. The result of this study is to enhance the efficiency and effectiveness of auto parts industries in Thailand and determine public policy direction for the competitive advantages in the global market.

Keywords: Reverse Logistics, Processing Development, Auto Parts Industries, Thailand

Introduction

Thailand is one of the world's largest production bases for the automotive and auto parts industry. The government seeks to support it as the manufacturing center of the global automotive and auto parts industry. The global automobile company has the policy to use the ASEAN region as a critical manufacturing strategy of the company, especially about 80% of the automobile parts used from Thailand, compared with the number of spare parts exports of Bank of Thailand (NEMETO Toshinori, 2010). As a result of the growth of the automotive and auto parts industries in Thailand with green supply chain management and logistics, both European automakers have become a global strategy. In particular, the USA and Japan, the automotive production base in Thailand and the ASEAN region, has little progress and is inconsistent with the development of industrial groups related to the global automotive and auto parts industry. Especially in the international situation facing the COVID-19 epidemic, enterprises around the world, including Thailand, need to revisit the development of reverse logistics management processes to lead to cost reduction and environment friendly

The study of the development of the reverse logistics management process of the auto parts industry in Thailand is part of the action of environmentally friendly logistics systems. It is to study and develop a reverse logistics process in various ways, such as environmentally friendly product design. Products designed to save energy (eco-design) design tools from assessing the life cycle of products to study the feasibility of managing operations in the auto parts industry and understanding the upstream parts involved concerning vendors, inputs in logistics, and supply chain management processes. A study of the characteristics, methods, and procedures of integration from purchasing, information, production, and vertical integration channels. Quality management, which is a factor in which this research will study, is not merely an academic study. The product reverse process explains why, what, and who is involved in reverse logistics and product rollback processes.

The auto parts industry in Thailand and the automotive parts manufacturers in Thailand need to adjust to strengthen the design and development capabilities. Along with improving the quality of production and reducing production losses by enhancing production technology and creating a competitive advantage in the environment-friendly logistics and supply chain management processes while reducing logistics costs. It is mostly a critical decision made by the logistics manager of the manufacturing industry. Including government agencies involved in the formulation of policies and national strategic plans for logistics and supply chain. It is a decision in reverse logistics management processes and environmentally

friendly supply chain management, which must carry out while reducing logistics and supply chain costs, taking into account the highest efficiency and effectiveness in business performance. It leads to the formulation of a national logistics and supply chain policy so that the Thai auto parts industry can survive and compete in the global competitive arena. Therefore, this study wants to study the development of reverse logistics management processes in the auto parts industry in Thailand under the Thai and international green logistics regulations. It will lead to reverse logistics management in the logistics system and the environmentally friendly supply chain for the auto parts industry in Thailand and related industries. Including the government and the private sector, apply in formulating national and international policies on such matters to create a competitive advantage for the automotive parts industry in Thailand.

Literature review

The automotive and auto parts industries are considered very important to the development of the Thai economy. Thailand is the most extensive automobile manufacturing and export base in ASEAN. The automotive and automotive parts industry deal with More than 160 enterprises such as steel, plastic, rubber, and electronics—the smallest automotive parts manufacturers (Stage 2 and Stage 3). Most manufacturing plants still have outdated manufacturing processes. And high energy consumption also pollutes the environment. Therefore, green logistics and green supply chain management of the automotive and automotive parts industry in Thailand. Will focus on the evaluation and optimizing these processes to reduce their impact on the environment and reduce energy consumption (Olugu et al., 2010), and have been facing a severe drop in sales since 2018. The past has aggravated, causing a severe slump in sales due to the COVID-19 epidemic situation.

Reverse logistics in the automotive and auto parts industries has become a significant interest in the industry. It is a model for reducing costs and adding value to the supply chain and environmental issues, which have become a crucial global agenda (Olugu et al., 2010). In the automotive and auto parts industry, very few studies conduct management and its relationship with industry performance. Therefore, applying the green concept to the automobile and auto parts industry is essential to reduce the environment's impact. Steal and gain a competitive advantage in the market. And ensuring compliance with environmental legislation regulations (Gan, 2003).

Thailand gears towards sustainable development. It ratified the Johannesburg Declaration in 2002 and the Manila Declaration on Green Industry in 2009, the Ministry of Industry, the main body in Thailand's economic development. Therefore, the strategy for industrial development for the environment and society establishes. By taking proactive action to focus on promoting and developing the industrial sector to grow and sustainable development to make concrete, therefore, the green industry project was initiated to encourage the industrial sector to be environmentally friendly and social enterprises.

As a result, the industrial sector has the right image, credibility, and public trust. And creating a green economy will make the country's green gross product (green GDP) higher as well. (Automobile Institute, 2017).

Environmental actions have formed in the automotive and auto parts industries in developed countries. The key evidence is that in the European Union (EU) countries, the ELVs directive (2000/53 / EC) requires industry manufacturers to establish production plans to reduce their toxic materials consumption.

Vehicle design and manufacturing towards dismantling, reuse, remanufacturing, recovery, recycling, and end-of-life. It also uses more new uses and production without mercury (mercury) as an ingredient, including ingredients from Hexavalent chromium, cadmium, or lead, which is the driving force behind the automotive and auto parts industries towards empathy, greenness, and friendliness. The main drivers of reverse logistics, like Chan, Chan, and Jain (2011), outlined the main drivers of reverse logistics in the automotive industry.

There are reasons or multiple drivers. Reverse logistics cannot be avoided for the logistics of retracements when products at the end of the supply chain always have a chance to reverse due to warranty recalls. There are familiar drivers of reverse logistics: Business drivers (economic) marketing and legal incentives (Ranade, 1999), the responsibilities that businesses have on the impact of their business operations on society (corporate citizenship), and environmental laws and issues. (Ravi, Shankar et al., 2005). It also includes both direct and indirect business drivers. Legal and Social Responsibility (Shankar, 2015).

The main drivers for reverse logistics are:

The inevitable return

The unavoidable return of a product can include many reasons: a defective product that causes a recall or a work that is not of the guaranteed quality after it sells. And still, under warranty, the customer takes the result back to repair at the center where the reverse logistics begins.

Environmental concerns

Today's people are more focused on environmental issues. By creating a greener brand for the environment and creating new markets for returned goods. (Fleischmann, Beullens et al., 2001), the environmental concept of waste or garbage disposal. It suggests that used items can be reused and reused without always going to a landfill. Therefore, waste is less, and useful materials use more discretion to protect the environment by calling this concept cradle to cradle (Kumar and Putnam, 2008).

Law enforcement

The law will help support the implementation of reverse logistics (Chan, Chan and Jain, 2011), with many countries now enforcing expired product recovery legislation. Manufacturers are required to pay for the removal of waste. And expenses for the collection and reuse of unused items. Reusing and reusing useful materials from expired items can reduce the amount and size of trash.

On the business side

The successful reverse logistics controls can facilitate members of the supply chain and improve both environmental and business performance. The company can find an opportunity to reduce the cost of handling waste by repairing waste products. Reusing, refurbishing, reproduction, or reuse of valuable and useful merchandise or materials, for example, in the cordless telephone business, 70% of phones are collected and refurbished for reproduction. Of collected phones can be cost-effectively remanufactured (Guide, Teunter et al., 2003).

Social responsibility

Companies can use reverse logistics for corporate social responsibility (CSR) activities of interest to today's customers. It creates the reliability and competitiveness of the brand (Marien, 1998). Leading companies need to develop an environmentally friendly business so that the company's reputation does not cause damage and loss. Lose income.

The remaining impulses are product recall, laws of disposal, and value of returned parts and components (Chan., Chan et al., 2011) with the following details:

1) Product recall to guarantee the quality of car manufacturers' products Companies must be prepared for product recalls and repair services to maintain a high customer service level.

2) Waste disposal laws are the most effective stimulants in the enforcement of reverse logistics when the waste generated by the vehicles to disposes of can harm the environment. Contamination of one million liters of water bodies and the oil that seep into the soil will affect the earth's fertility. The law also forces automakers to cover costs associated with the disposal of

parts and components. It makes manufacturers turn their attention to reusing what is still useful in their supply chains to make the most of their products.

3) The value of returned parts and components a large number of researchers support that produced vehicles are valuable for recycling. Due to the limited resource of steel, aluminum, copper, etc., the automotive industry will focus on reusing steel to provide the reverse of the product to the maximum value. Manufacturers must focus. Reverse logistics by working with more part plants by creating a network of authorized recovery based on an end-of-life vehicle (ELV) operation.

The literature review of this research factors leading to the development of reverse logistics processes in the auto parts industry consists of 9 groups of variables: collection for reuse. Warehouse management Environmentally friendly operations, transportation, retroactive logistics operations within the organization Economic Action Environmental Awareness Cooperation in the reverse logistics chain network and reverse logistics management system (Zhu et., al., 2005; Awasthi et al., 2010; Jain and Sharma, 2012; Zhu, Sarkis, and Lai, 2008).

The results of the literature review could create a conceptual framework for this research as follows:

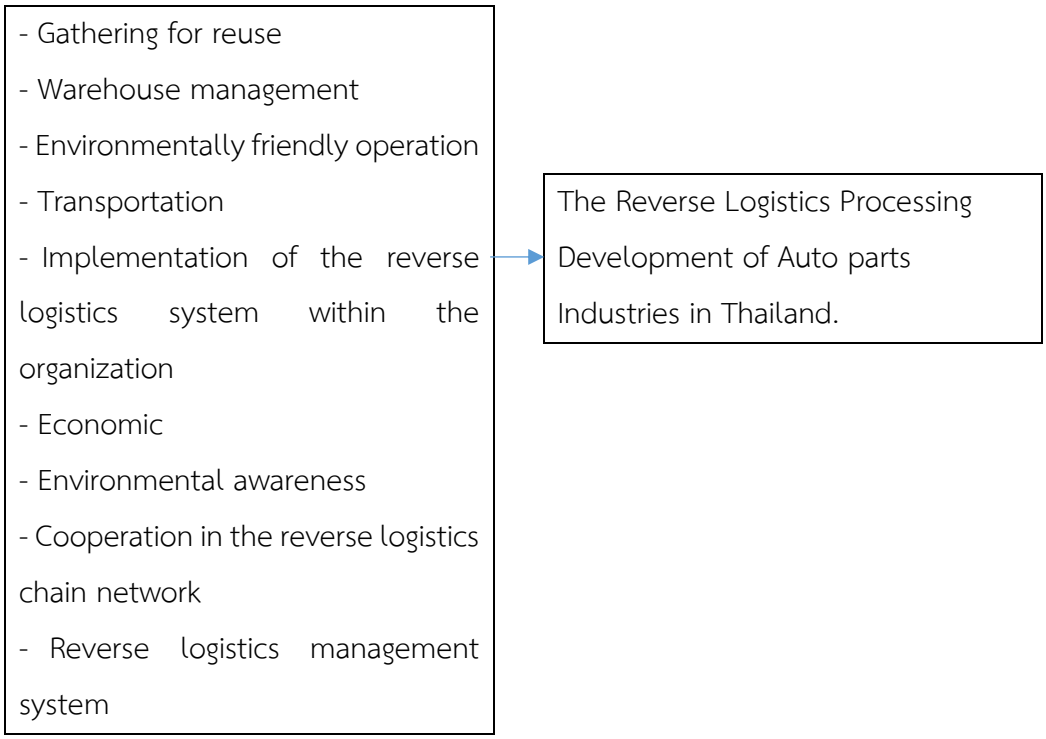

Figure 1 Conceptual framework of the reverse logistics processing development of auto parts industries in Thailand.

Research Methodology

By using a questionnaire that designs from intensive literature. Reviews with 30 auto parts industry operators until the variables obtain. To create a model parameter, generate a query using questionnaires to test the validity and reliability by providing the experts in green logistics and the green supply chain. And green scholars logistic and green supply chain three persons check the accuracy of the gauge. The reliability of the meter then testes. To test the pilot test of 30 samples are the automotive parts industry, both with a green operation, logistics, and green supply chain. And do not operate the green logistics and supply chain rationale to obtain an example of different green opinion characteristics. Cronbach's alpha test statistics use and the test carry out until the scale was reliable before using sample interviews in the survey research.

Population The population is the auto parts industry in Thailand. Which is a part operator automotive: 17 companies, manufacture of parts, 635 tier 1 parts manufactures companies, 1,700 companies (tier 2, 3parts manufactures companies), 2,359 companies (Thailand Automotive Institute, 2017)

Sample A stratified sampling from the auto parts industry in Thailand conducted, a group of auto parts assembler in quantitative research Industrial groups of parts manufacturers, tier 1, tier 2, 3. And sampling from industries with locations in each region (northern, central, eastern, western, and southern regions). It interviewed the logistics and supply chain operations manager. This critical position can provide information and a footprint on developing the auto parts industry's logistics management process. They can perform well in Thailand as a junior executive and have a good understanding of the operational level.

Research statistics in this research using methodology for quantitative analysis. By using several 386 samples by using a questionnaire.The questionnaire tests to measure the proportion of the question structure in the questionnaire scale. To achieve validity and reliability using Cronbach's alpha analysis, followed by factor analysis. To confirm the independent variable affecting the dependent variable was approved by the literature review. The next step was to perform the study using a one-way analysis of variance (ANOVA) to determine the variable's value. They were different and correlated with factors affecting the development of reverse logistics management processes of the auto parts industry in Thailand. By considering only, the variables affecting the readiness and the potential for the development of reverse logistics management processes of the auto parts industry in Thailand. Based on the use of correlation analysis to confirm the number of variables. And find the

independent variables most affecting the dependent variable. The multinomial logit model constructs to predict the relationship between independent and dependent variables.

Research Results and Discussions

Table 2 Number and percentage of auto parts industry that has developed reverse logistics management processes in the auto parts industry in Thailand Classified by groups of response variables were auto parts industry, tier 1, tier 2, and tier 3.

Auto parts industry	values of frequency variables	Total Frequency	Percent
Level parts manufacturer Stage 1 (tier 1)	1	78	20.21
Level parts manufacturer Stage 2 (tier 2)	2	92	23.80
Level parts manufacturer Stage 3 (tier 3)	3	216	56.00
Total		**386**	**100.00**

The analysis of response variables as per the objectives of this research to find answers about reverse logistics management. Processes in the auto parts industry in Thailand. And the selection of suitable models for the data analysis is divided into three parts as follows.

From Table 2, it shows that 386 auto parts industries are the automotive parts industry with logistics management developed. Among 216 automotive parts manufacturers at the tier 3 level, accounting for 56.00 percent, followed by the auto parts industry, developed reverse logistics management processes. Among 92 companies of the tier 2 parts manufacturers, accounting for the lowest 23. 80% , the auto parts industry with the development of reverse logistics management processes, among 78 companies of the tier 1 parts manufacturers, accounting for 20.21 percent.

Table 3 The Wald and P-value statistics for the effect of the described variable on the response variable.

Effect	DF	Wald statistics	P - value
Warehouse management (WMT)	2	46.1248	0.0000
Transportation (TPT)	2	62.7594	0.0001
Implementation of an internal reverse logistics system (IRL)	2	55.6421	0.0005

From Table 3, it is shown that the descriptive variables were selected in the logical model. With the stepwise method of selecting variables by likelihood ratio, namely

Table 4 Coefficient Estimates of Logical Models If the response variable is out of sequence

Parameter	Goals	DF	β	S.E. (β)	Wald Statistics	P - value
Intercept	1	1	0.2534	0.2581	16.1001	0.0000
Intercept	2	1	0.4125	0.1854	8.7921	0.0001
WMT	1	1	- 0.1982	0.1725	15.2583	0.0000
WMT	2	1	- 0.1789	0.1451	9.2365	0.0251
TPT	1	1	0.2440	0.1127	23.5241	0.0127
TPT	2	1	0.3256	0.1590	11.8549	0.1237
IRL	1	1	- 0.1684	0.1486	23.5548	0.0000
IRL	2	1	0.2841	0.1601	31.1352	0.0000

From Table 4, the coefficient estimation of the logical model obtained by estimation of maximum likelihood can be written as follows:

$$\log(\hat{\pi}_1/\hat{\pi}_3) = 0.2534 - 0.1982\,WMT + 0.2440\,TPT - 0.1684\,IRL$$
$$\log(\hat{\pi}_2/\hat{\pi}_3) = 0.4125 - 0.1789WMT + 0.3256\,TPT + 0.2841\,IRL$$
$$\log(\hat{\pi}_1/\hat{\pi}_2) = -1.8521 + 0.2874WMT - 0.5236TPT + 0.2561IRL$$

Probability that the auto parts industry developing reverse logistics management processes in the auto parts industry in Thailand will be among the tier 1 parts manufacturers (tier 1) can write the equation is as follows:

$$\hat{\pi}_1 = \frac{e^{0.2534-0.1982\,WMT+0.2440\,TPT-0.1684\,IRL}}{1+\underset{+}{e^{0.2534-0.1982\,WMT+0.2440\,TPT-0.1684\,IRL}}\ e^{0.4125-0.1789WMT+0.3256\,TPT+0.2841\,IRL}}$$

The probability that the auto parts industry with the development of reverse logistics management processes in the auto parts industry in Thailand is among the tier 2 parts manufacturers can write the equation is as follows:

$$\frac{e^{0.4125-0.1789WMT+0.3256\,TPT+0.2841\,IRL}}{1+e^{0.2534-0.1982\,WMT+0.2440\,TPT-0.1684}+e^{0.4125-0.1789WMT+0.3256\,TPT+0.2841\,IRL}}$$

The probability that the auto parts industry with the development of reverse logistics management processes in the auto parts industry in Thailand is among the tier 3 parts manufacturers able to write equation getting as follows

$$\hat{\pi}_3 = \frac{1}{1+e^{0.2534-0.1982\,WMT+0.2440\,TPT-0.1684}+e^{0.4125-0.1789WMT+0.3256\,TPT+0.2841\,IRL}}$$

Table 5 Deviance and Pearson goodness-of-fit statistics in case of no-sequence response variables.

Criterion	Value	DF	Value / DF	P - value
Deviance	864.7785	632	1.0535	0.1863
Pearson	654.8524	632	1.0965	0.2698

From Table 5 it shows that the deviance statistic is 864.7785 and the Pearson statistic is 654.8524, giving P-values 0.1863 and 0.2698, respectively. Since the P-values are both greater than 0.01, the model is suitable to use. In the forecast at the statistical significance level 0.01

Table 6 -Approximate values for odds ratios in cases where the response variable is sequence

Effect	Goals	Point Estimate	99% Wald Confidence Limits
WMT	1	1.785	(1.123, 1.002)
WMT	2	1.632	(1.523,1.962)
TPT	1	1.789	(1.222, 0.852)
TPT	2	1.682	(1.222, 0.852)
IRL	1	1.631	(0.082, 1.364)
IRL	2	1.856	(1.167, 1.055)

Table 6 shows that the auto parts industry develops reverse logistics management processes that focus on warehouse management for the reverse product (WMT) probability that the parts industry has. Vehicles that have created a reverse logistics management process will be among the tier 1 parts manufacturers and the auto parts industries among the tier 3

parts manufacturers. The auto parts industry without warehouse management for the reverse product (WMT) was 1.785 times, and the 99% confidence interval of the Wald was (1.123, 1.002). And the auto parts industry where a reverse logistics management process develops with a focus on warehouse management for the reverse product (WMT), which is more in the auto parts industry, tier 2 parts manufacturers. In the auto parts industry, the manufacturers of tier 3 parts were 1.632 times more than in the auto parts industry without warehouse management for the reverse product (WMT) and a 99% confidence interval of Wald is (1.52 3, 1.962)

The auto parts industry has developed a reverse logistics management process that prioritizes reverse product transport (TPT). It is in the auto parts industry among the tier 1 parts manufacturers rather than the warehouse management for the reverse product (WMT) in the auto parts industry among the tier 1 parts manufacturers. Tier 3 parts manufacturers was 1.789 times less than the auto parts industry, where the final warehouse management for the reverse product(WMT) s ships and the Wald's 99% confidence interval is(1.222, 0.852).

With the development of a reverse logistics management process, the auto parts industry puts a priority on reverse product transport (TPT). It is 1.682 times more in the auto parts industry in the tier 2 part manufacturers segment than in the auto parts industry, which prioritized reverse product transport (TPT) was 1.682 times, and the confidence interval. The 99% conviction of Wald is (1.222, 0.852).

The auto parts industry, with the development of reverse logistics management processes that focus on the internal reverse logistics (IRL) system, has opportunities in the auto parts industry among parts manufacturers. In the auto parts industry, tier 3 parts manufacturers was 1.631 times higher than in the auto parts industry, and the Wald's 99% confidence interval was (0.082, 1.364).

The auto parts industry, with the development of reverse logistics management processes that focus on the internal reverse logistics (IRL) system, has opportunities in the auto parts industry among manufacturers. The Wald value is 1.856 times, and the confidence interval is 99%. The amount of the Wald is (1.167, 1.055).

It can conclude that the auto parts industry has developed a reverse logistics management process that focuses on warehouse management to deliver the reverse product. It is likely that the auto parts industry with the development of reverse logistics. Management processes will be among the auto parts manufacturers at tier 1partsmanufacturers, and auto parts industries are more among the tier 3 parts manufacturers than in the auto parts industry

without warehouse management to shipping products. Retrace and the auto parts industry with the development of reverse logistics management processes that focus on warehouse management to send reverse products. Which are in the auto parts industry, more than in the auto parts industry, tier 3 parts manufacturers than in the auto parts industry manage warehouse to send products to reverse.

The auto parts industry has developed a reverse logistics management process that prioritizes the transportation of reverse products. It is in the auto parts industry in the segment of tier 1 parts manufacturers. Rather than warehouse management, supply reverse products in the auto parts industry to tier 1 parts manufacturers less than the auto parts industry with warehouse management. For the final product return, and auto parts industry with reverse logistics management processes that focus on reverse product shipment. It is more in the auto parts industry than in the auto parts industry, where reverse product transport is the last priority.

The auto parts industry, with the development of reverse logistics management processes that focus on the internal reverse logistics (IRL) system, has opportunities in the auto parts industry among parts manufacturers. As for the auto parts manufacturers, tier 1 part manufacturers was more significant than in the auto parts industry, in the tier 3 parts manufacturers, and in the auto parts industry to develop reverse logistics management processes. The footprint that prioritizes corporate retraction logistics has more opportunities in the auto parts industry in the tier 2 parts manufacturers segment than in the auto parts industry. Producer of parts tier 3 parts manufacturers is the last.

Conclusions and Suggestion

The quantitative research results found that among the first tier parts manufacturers, which large industries were, serve in the manufacture and assembly of finished automotive parts such as engines, tires, bodywork, and interior accessories. Electronic braking systems, etc. are planned, are currently being considered. Some operations and we have been working hard to develop an environmentally friendly logistics system regarding as follows gathering for reuse warehouse management environmentally friendly operations transportation logistics implementation of retroactive logistics systems within economic organizations environmental awareness cooperation in the reverse logistics chain network reverse logistics management system.

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In the parts manufacturers, the first tier parts manufacturers had the knowledge, understanding, and importance of reverse logistics. It is considered reverse logistics as an essential strategy for the company. There is a reason that the company brings reverse logistics to operate in the company. As automakers, mostly Japanese and European groups are focused on the EU's WEEE regulations. Pressure from international investment partners such as Toyota, Honda, Ford, Daimler-Chrysler, GM, etc., mainly automotive parts manufacturers in Thailand, are under intense management pressure. It has to focus on being environmentally friendly from major automotive manufacturers In Thailand, including Toyota and Honda, there are practice and management of factory waste. Environmentally friendly products and packaging undertake to reduce scrap metal, reduce costs, create a competitive advantage, and meet conservation flows—environment for both consumers and overseas buyers.

The first tier of parts manufacturers is transmitting business information about recycling to build understanding to customers. There is planning. Some companies are working towards designing eco-friendly products in their factories by recycling and reusing and using adequate information systems to reverse Logistics in the factory. A recycling channel has been established to focus on implementing relevant environmental standards such as ISO14001 / REACH /ISO9000, etc. on quality management issues and quality certification certificates by In particular, the ISO14001 research shows that almost all of the first tier parts manufacturers have received a certificate of quality assurance, in particular, ISO14001, which is a certification in management and Environment friendly At the moment, the second-tier manufacturers receive approximately 90% of the ISO14001 level, while the rest are in the process of obtaining ISO14001 while the third tier manufacturers more than half do not have ISO14001, but the remaining third-tier manufacturers are still keen to enter the submission process or take action to obtain ISO14001 due to the pressures of parts manufacturers, the first tier, parts manufacturers, the second tier, which is a producer of inputs for foreign automotive assembly plants with a clear policy in the production system. In factories that must comply with the importing country's regulations, the quality management system within the factory of the parts manufacturers at all levels needs to be adapted to create a value chain in a green supply chain.

For an overview of driving reverse logistics in Thailand, the study results from the quantitative research method found that the auto parts industry in Thailand is still severely lacking in the adoption of logistics drive back into the auto parts industry. It is especially true among the second-tier and third-tier parts manufacturers due to the

government's lack of legal and policy support. Seeing the auto parts industry's retrospective logistics in Thailand does not affect promoting the company's image, and believe that it cannot lead to a reduction in production costs; on the contrary, the second-tier and third-tier parts manufacturers see that it will increase production costs as well. And it's not seen as a complementary to environmental protection and action. Or is it to improve customer service in any way, for obstacles to implementing reverse logistics in Thailand. The lack of enforcement of laws and regulations from both customers and automakers and the high operating costs and lack of economic policy support. Recycling technology is obsolete. More than 80% of the auto parts industry in Thailand lacked knowledge and understanding of public policy regarding retraceable logistics. And his reluctance to devote to managing and investing in reverse logistics. It also saw that it made it impossible to predict the demand for recycled products. The first tier parts manufacturers have a clear policy and management in terms of logistics. And expand into the entire green supply chain.

On the other hand, the second tiers of parts manufacturers in all dimensions in reverse logistics management were few. But that is being considered there are some the last segment in the auto parts supply chain is third-tier manufacturers, which are often small and medium enterprises (SMEs) and are the largest in the chain. Supply of the auto parts industry in all dimensions in the overall reverse logistics management still lacks reverse logistics. It is because stakeholders have not rejected it in the auto parts industry's supply chain. In the short term, it is considered not to lose competitiveness in the auto parts manufacturing industry. Somehow, however, the manufacturer of parts third-tier manufacturers in the near term if the third tier parts manufacturers do not adjust to meet the customer and vehicle manufacturers and the consignee, it may cause third-tier manufacturers to lose their customers and competitiveness as well.

A multinomial logit model in the case of response variables (dependent variables) is sequential. By defining the relationship of the response variable and explanatory variables (Independent variable) in the logic model, the model is a model baseline-category logit model when the response variable is sequential. In the overall driving of retroactive logistics in Thailand, it finds that the auto parts industry in Thailand is still severely lacking in reverse logistics into the auto parts industry. It is especially true among the second-tier and third-tier parts manufacturers due to the

government's lack of legal and policy support. Seeing the auto parts industry's retrospective logistics in Thailand does not affect promoting the company's image, and believe that it cannot lead to a reduction in production costs.

On the contrary, the second-tier and third-tier parts manufacturers see that it will increase production costs. And it's not seen as a complementary to environmental protection and action. Or is it an improvement in customer service in any way.

For a guide to bringing the reverse logistics processing development of auto parts industries in Thailand, relevant agencies and governments should have the following logistical actions: increase awareness and awareness of environmental protection and preservation. Enforcement of regulations, laws, and regulations for environmentally friendly operations should not adopt. Instead, measures should incentivize the auto parts industry and recognize the importance of corporate image and point out that it can reduce costs and increase competitiveness in the long run. Provide financial, administrative, and infrastructure support to operate in an environmentally friendly manner. Energetically adopt environmentally friendly design/ manufacturing in the production of automotive and automotive parts. The government should come to support investment in logistics technology, retrace both education and technology. And have tax incentives, etc. The auto-parts industry should carry out reverse logistics, integrating forward and forward logistics.

Future research

The research that relates and extends the knowledge from the reverse logistics management of the auto parts industry in Thailand that is most interesting and possible to study. Competitive advantage for the Thai auto parts industry with reverse logistics management or green supply chain adjustment and reverse logistics for the Thai auto parts industry to create a competitive advantage in Thailand.

References

Automotive Information Center (2017). *State of the automotive industry*. Retrieved from http://data.thaiauto.or.th.Thailand

Automotive Institute, *Automotive and Auto Parts Industry*, (Online). (2017). Available: http://www.thaiauto.or.th/Automotive Industry Action Group (AIAG). *The Business Case for ANX Service*.Available at: http://www.anxo.com/TP_SP/papers/TEL-3.pdf.

Awasthi, Amit& Singh, Nirankar& Mittal CchemFrsc, Susheel& Gupta, Prabhat&Agarwal, Ravinder. (2010). Effects of agriculture crop residue burning on children and young on PFTs in North West India. *The Science of the total environment*, 408, 4440-5.

Chan, Felix & Chan, H. & Jain, Vipul. (2011). *A framework of reverse logistics for the automobile industry.International Journal of Production Research* - INT J PROD RES,50,1-14.

Fleischmann, M., et al. (2001). The Impact of Product Recovery on Logistics Network Design.*Production and Operations Management*,10,156-173.

Gan, Lin. (2003). Globalization of the automobile industry in China: Dynamics and barriers in greening of the road transportation. *Energy Policy*,31, 537-551.

Guide, Daniel &Teunter, Ruud & Van Wassenhove, Luk. (2003). Matching Demand and Supply to Maximize Profits from Remanufacturing. *Manufacturing & Service Operations Management*, 5, 303-316.

Jain, V.K. and Sharma, S. (2012). Green Supply Chain Management Practices in Automobile Industry: An Empirical Study. *Supply Chain Management Systems*, 1(3).

Kumar, Sameer & Putnam, Valora. (2008). Cradle to cradle: Reverse logistics strategies and Opportunities across three industry sectors. *International Journal of Production Economics*,115, 305-315.

Ondemir, Onder&Ilgin, Mehmet Ali & Gupta, Surendra. (2012). Optimal End-of-Life Management in Closed- Loop Supply Chains Using RFID and Sensors. Industrial Informatics, *IEEE Transactions*, 8, 719-728.

Olugu, Ezutah& Wong, Kuan& M Shaharoun, Awaluddin. (2011). Development of key performance measures for the automobile green supply chain. Resources Conservation and Recycling – *Resour ConservRecycl*, 55, 567-579.

Shankar, Ravi. (2015). Survey of reverse logistics practices in manufacturing industries: An Indian context. *Benchmarking: An International Journal*, 22, 874-899.

Tibben-Lembke S. Ronald and Rogers S. Dale.(2002). Differences between forward and reverse logistics in a retail environment, Supply Chain Management: *An International Journal*, 7(5), 271-282.

Zhu.Q., Sarkis. J. & Geng. Y. (2005). Green supply chain management in China: pressure, practices and performance. *International Journal of Operations and Production Management*; 2005; 25, 5/6

Zhu.Q. Sarkis.J.and Lai K. (2008). Green supply chain management implications for "closing the loop" *Transportation Research*. Part E44 (2008) 1-18.