

-RESEARCH ARTICLE-

## THE OPTIMIZATION OF LOGISTICS MANAGEMENT OF THE RUBBER WITHIN BURIRAM OF THAILAND FOR ASEAN

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### —Abstract—

This research investigates the management issues, costs, and expenditures, as well as the optimization of the rubber logistics system for ASEAN rubber growers and distributors in Buriram. The samples consisted of 345 individuals from 23 areas. The results indicated that only trucks are now employed for transport. The management issue ranged from moderate to severe. The cost of trucks from Buriram to the place of purchase in Nong Khai province for ASEAN was 8,232 baht per trip, 8,395 baht to Nakhon Phanom, 8,439 baht to Laem Chabang Port in Chonburi, and 665-1,329 baht at Ampure Muang in Buriram. However, the cost of the intermediary was higher. Therefore, entrepreneurs should concentrate on the growth of logistics employees. The government should expand faster logistics, such as high-speed rail links between nations, or permit the private sector to participate in developing the logistics system.

**Keywords:** Optimization, logistics system management, rubber, ASEAN countries, management problems, cost and expenditure of logistics

### 1. INTRODUCTION

In Buriram Province, there has been an increase in rubber planting in various regions over the past decade [Replanting. \(2015\)](#), and a central rubber market has been established under the name Buriram Provincial Agricultural Research. This market is considered the first center of the northeastern region and serves as a market for rubber planting products produced by farmers. In addition, introducing the rubber mentioned above was another way rubber farmers could cut transportation costs. [Replanting. \(2015\)](#) disclosed that in 2015, Buriram had a rubber plantation area both in the rubber- planting project

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to increase income in the first phase and the ecological restoration project (CEO), covering more than 157,600 rai in the province, where 14,400 parakeet farmers are located. The districts with the most growth were Ban Kruat, Lahan Sai, Khu Mueang, Satuk, and Non-Suwan, where farmers have now slitted more than 75,000 rai. According to the poll, the number of farmers interested in growing rubber increased by about 20,000 rai in 2015 compared to the previous year because the price of rubber climbed to nearly 100 baht per kilogram, encouraging farmers to plant more rubber.

In contrast to the previous year, the price was only 50-60 baht per kilogram (news, 2014). This was consistent with K. W. e. al (2014) microeconomic theory, which states that when the price of a product rises, producers believe they will earn more profit and increase their output accordingly. So it was anticipated that the rubber plantation would continue to expand its planting area. From the statistics, it was determined that farmers would earn at least \$1.6 billion in 2015 from the sale of sliced latex. According to the preliminary survey and study, the logistics system for rubber distribution in Buriram Province has the following issues: 1) Rubber growers had less knowledge of the entire logistics market system, 2) Rubber growers and distributors were primarily from different groups, so production and transportation costs were notably high, 3) The domestic logistics system was still inefficient in terms of management, and 4) The logistics system connecting to the ASEAN region was also inefficient. According to the four problems revealed by the researcher and the assessment of research data, no other researchers in Thailand have explored and researched solutions to these problems in Buriram Province.

There is the only research on problem-solving in other provinces, but the problems are distinct. Sommat Uttarak (2011), for instance, evaluated the rubber logistics management system in the southern region, focusing solely on the cost of exporting to other nations, while other researchers focused on various concerns in other provinces. This study's objectives were as follows: (1) to examine the empirical issues of logistics management of agencies within Buriram province, with an emphasis on the problem of distribution of goods to various points of purchase for ASEAN countries; (2) to examine the costs and expenses of logistics management in Buriram Province to distribute goods to various points of purchase for ASEAN countries; and (3) to examine and analyze the ways to optimize the management of logistics systems. The format of the remaining study consisted of a review of past concepts, theories, and research, a method of information collection, an analysis of the results and a discussion of the findings, and a conclusion with policy recommendations for the benefit of agencies in Buriram Province and other provinces.

## 2. LITERATURE REVIEW

### 2.1 Logistic Management

The logistics system is crucial for the rapid delivery of products to consumers. Efficient logistics management will provide operators with substantial cost savings. Logistics is the management of all activities associated with coordinating and moving supply and demand at a given time and location. (Porter, 2012). Logistics is the planning, operating, and controlling of the efficiency and effectiveness of the movement and storage of raw materials, work-in-progress, finished commodities, and related information from the origin to the site of consumption in response to client demand (other., 1988).

Supply Chain Management is a management process in every stage, beginning with the importation of raw materials, the production process, and the ordering process, and concluding with the delivery of the product to the client to ensure maximum efficiency and continuity. The success of the logistics system depends on the planned work process and the company's information, and only internal stakeholders are aware of its existence. Factors that foster collaboration include mutual trust, sharing identical data, the quality of shared knowledge, and information and communication technologies. However, the development and management of logistics are influenced by Intense Competition, Globalization, Uncertainty, Trust, Coordination & Cooperation, and Sharing of shared information. (Tanit, 2007)

### 2.2 Selling Products to ASEAN Countries

ASEAN nations are the world's leading producers of rubber. Thailand, Indonesia, and Malaysia are the top rubber producers and exporters, whereas China is the largest rubber consumer in the world. If rubber is only sold in Thailand, the country's GDP will not expand significantly. Still, the country's income will increase if it is also sold overseas, particularly for distribution in ASEAN nations. Diverse ASEAN nations will import rubber to make or process it for sale on the global market. ASEAN consisted of ten countries: Brunei, Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

Thailand, Indonesia, and Malaysia produced greater than two-thirds of the world's rubber in 2015. Since 1991, Thailand has consistently produced the most rubber on the market. In 2015, Thailand produced over 4.5 million tons of rubber, accounting for 36 percent of the global total. Thiamthetkaew (2015), per the Office of Agricultural Economics. Thailand will deliver rubber to ASEAN countries through the borders of three neighboring countries: Laos, Cambodia, and Malaysia. Other nations will trade through these three nations (D. K. e. al, 2009).

### 2.3 Problems in Logistics Management

The problems of logistics systems in Thailand are as follows: 1) the rubber delivery problems ranging from the logistics management of the operators to the customers; 2) problems with the infrastructure of various logistics systems, such as the lack of high-speed trains; 3) problems with the potential to become a hub in ASEAN due to the lack of policies and cost of driving; and 4) the problem of systematic linkage of economic activities, such as the problems about the insufficient linkage between the agricultural sector and the manufacturing sector. Water and air are the challenges of logistics system centralization (Atikomrattanakul, 2007). However, the ineffective logistics strategy and regional distribution hub provide the greatest barrier to Thailand's development as an ASEAN logistics hub.

The constraints to the growth of the Thai logistics system can be categorized as follows: 1) Problems with the transportation infrastructure and trade facilities; 2) Problems with government policy; 3) Problems with rules, regulations, and regulations; 4) Problems with the development of the logistics workforce; 5) Problems with logistics service providers; 6) Problems with information technology systems. 7) Problems with management, and 8) private sector participation in seminars, discussions, and exchanging ideas at key policy-making forums (Sorat, 2007). Thailand should separate the logistics system development concerns into five groups. Group 1: logistics issues connected to rules and regulations; Group 2: infrastructure issues; Group 3: logistics-related issues. Information Systems and Databases for Logistics Group 4: Personnel and Logistics Knowledge Problems and Group 5: Development Problems for Logistics Service Providers ((NESDB), 2014).

### 2.4 Logistics Cost

Logistics cost refers to the expense incurred by a business when utilizing the logistics services of an enterprise to conduct various economic activities. Logistics costs consist of three components: Part I, freight costs, which are the expenses incurred by the business owner to move goods from the source of production to the destination or final consumer, excluding the carriage of passengers; Part 2, Inventory Holding Cost, consists of two sub-sections, namely inventory carrying cost and warehousing cost; and Part 3, Distribution Cost, consists of two sub-sections, namely distribution cost and transportation cost. The in-stock cost of ownership is the cost of holding a product or the opportunity cost of money invested in the goods. The cost calculation of having interests uses the average of the Average Minimum Lending Rate to represent the opportunity cost.

Service activities incur in-inventory management costs within the warehouse, storing goods, and selecting factory and warehouse locations. These costs are not divided and are buried in logistics operations; they are estimated to account for 10 percent of the overall cost of transportation and inventory (Apichayasakul, 2010). The classification of transportation costs according to their Measurement is separated into two types: 1) Fixed

cost (Fixed Cost) is the cost or expense that does not vary based on the entrepreneur's level of production. This expense will incur a fixed amount. How much will the business owner produce? 2) Variable Cost is a cost or expense that varies according to the quantity of production, also known as Operation Cost, in which if a large amount of transportation is conducted, this type of cost will be high, such as fuel costs, repair costs, etc. (Planning, 2011). Because there hasn't been much change, it is straightforward to determine this fixed cost. Because variable costs depend on resource usage, a suitable criterion for calculating them must be identified; this criterion is known as the Cost Driver. Fixed expenses include vehicle depreciation, the salary of a permanent employee, the cost of vehicle insurance, and loading and unloading expenses. Variable expenses include temporary employee charges, permanent employee overtime, temporary employee overtime, and vehicle maintenance expenses.

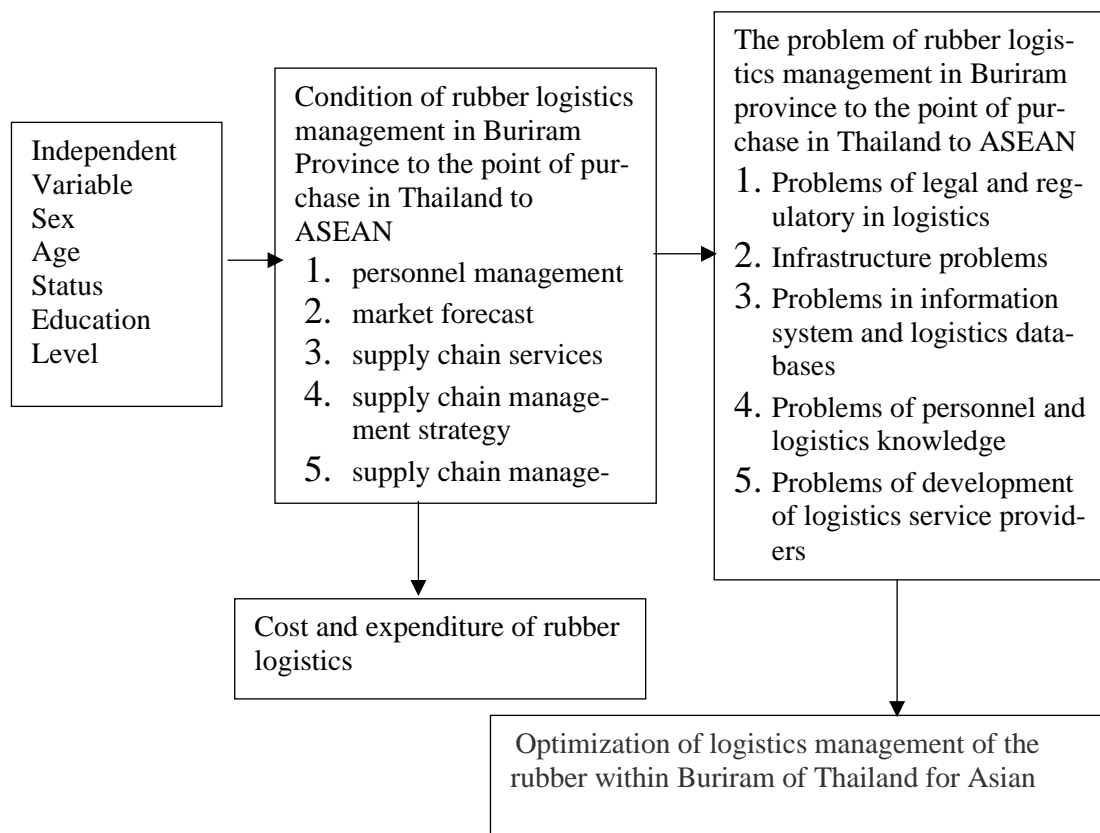
Cost drivers are fuel price, distance, and fuel consumption. Therefore, the model for calculating the freight costs is  $\text{Transportation Cost} = (\text{truck depreciation} + \text{full-time employee salary} + \text{car insurance} + \text{loading and unloading}) + (\text{temporary employee expenses} + \text{overtime, permanent and temporary employees} + \text{vehicle maintenance costs. vehicle}) + (\text{fuel price} \times \text{distance} \times \text{fuel consumption rate})$ .

## 2.5 Empirical Literature

Chaichompoo (2006) studied the logistics management process of rubber for export to China, which investigated the northeastern region of Udon Thani Province. Overall, it was discovered that they were shipped to the point of purchase in Chonburi province. The cost per journey that year was 5,000 baht, and it was suggested that the government promote and manage infrastructure, facilities, and transport rules, as well as provide support for rail and ship travel. Using statistics, percentages, the mean, and the standard deviation, Company (2009) investigated the topic of enhancing the Thai logistics industry's competitiveness.

The results indicated that the Thai logistics management cost-reduction plan should emphasize the development of computer systems or technology to replace hiring employees. Center (2011) examined rubber's Northeastern logistics and transportation management. In 2011, it was discovered that transporting rubber from the northeastern region from Nong Khai province to Bangkok port or Laem Chabang Port was the cheapest. Transportation between Nong Khai and Laem Chabang Port costs roughly 14,000 Thai Baht. According to this study, Buriram is a brand-new province for rubber plantation and distribution. This year, there is no study to solve the problem in the region. Still, the market for distribution inside the province and sales to other purchase points in other provinces is beginning to develop.

### 3. RESEARCH FRAMEWORK



**Figure 1.** Research Framework

### 4. RESEARCH METHODOLOGY

4.1 In data gathering instrument development, The researcher analyzed the review literature regarding the logistic and supply chain, the problems of the logistics and supply chain management, the cost and expenditures of the logistics and supply chain, and the optimization of the logistics and supply chain management, and created the research tools such as a quantitative questionnaire to survey the data and an interview form systematically. The quantitative questionnaire was evaluated for IOC values by three specialists. Before analyzing data from actual samples, the researcher evaluated the study equipment with 30 additional samples and attained a Reliability of 0.80. The researcher contacted relevant entities, such as the Agricultural Research and Development Center of Subdistrict administrative organizations in Buriram, to obtain the necessary information for conducting the research.

4.2 The research sampled Buriram's population in 2015 was 1,536,722, comprised of 767,131 males and 767,591 females, and there are 14,400 rubber growers in 23 districts (Replanting., 2015). The researcher assigned the sample group for this study based on the total number of 23 districts. The researcher sorted the sample into two groups using the following criteria: The first group consists of rubber producers from 23 districts, with a quota of 15 individuals per district, resulting in a total sample of 345 individuals who were then randomly selected based on the following conditions: 1) Each rubber producer must have a land area of at least 5 rai, and 2) they must be willing to participate in research in which they will be questioned about the problem's condition, transportation expenses, and how to handle logistics at every step.

4.3 The second group consists of 20 direct rubber distributors who were selected using Purposive Sampling and Quota Sampling under the following conditions: 1) being a rubber distributor in Buriram and able to link to the ASEAN region; and 2) being willing to participate in the research in which the researchers can ask about the condition of the problem, the cost of transportation and how to manage it, logistics and supply chain at each step.

4.4 Utilizing statistics for analysis, the researcher used percentage, Mean, Standard Deviation, T-test, and F-test because these statistics aid in analyzing a clear picture. For example, percentage provides a basic classification to reveal gender, age, income, and occupation and can be used as data to analyze opinions on various issues. The use of mean and standard deviations is to examine the degree of opinion regarding the problem conditions, and the use of T-tests and F-tests is to help explain the positive or negative opinion link between the dependent and independent variables. The statistical formula is as follows:

$$\bar{X} = \frac{\sum fx}{n}$$

Where

$$\bar{X} = \text{mean}$$

$$\sum fx = \text{The sum of all the scores of the group}$$

$$n = \text{the number of points in the group}$$

$$SD = \sqrt{\frac{\sum fx^2}{n} - \left[\frac{\sum fx}{n}\right]^2}$$

Where

$$S.D = \text{Standard Deviation}$$

$$\sum fx^2 = \text{The sum of squares of each opinion level in the sample}$$

$[\sum f x]^2$  = square of the sum of Each person's opinion level in the sample

$n$  = the number of people or information

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where:

- T = t-Distribution
- $\bar{x}_1$  = The mean of the data in sample 1
- $\bar{x}_2$  = The mean of the data in sample 2
- $s_1^2$  = Data variance in sample 1
- $s_2^2$  = Data variance in sample 2
- $n_1$  = Sample size 1
- $n_2$  = Sample size 2

$$F = \frac{MS_b}{MS_w}$$

Where

$MS_b$  = Mean Square between groups

$MS_w$  = Mean Square within groups

Afterward, the researcher summarizes the various statistics, analyzes, discusses the results, and prepares complete research.

4.5 The procedure of data collection; The researcher set out the data collection methods as follows: 1) 20 research students were distributed in the designated areas to collect the data, 2) collect data from the focus group meeting, and 3) The researcher collect some incomplete data by myself.

4.5 General Information; Most of the respondents are male, aged between 41-50 years old, married, and graduated in the level of Vocational Certificate/Higher Secondary Education; the Period of planting/business relating to rubber mostly was in the range of 6-10 years. The form of the legal establishment was mostly in the form of a sole proprietorship.

## 5. RESULT

The researcher conducted the research according to the established process and summarized the research results according to the objectives with details as follows:

## 5.1 General Information About Rubber Plantation

In the functioning of their businesses, the majority engage outside workers to perform logistics. They cannot monitor shipping efficiency due to a lack of measuring equipment and experience. They do not analyze based on inventory management and forecasts and instead await a response before acquiring from the government or selling to various international corporations. Most of them will sell rubber in latex form, which requires little investment in logistical hardware.

Less of them sell by themselves and transport by vehicle routes, focusing mostly on selling at the Buriram rubber market and stressing the sale of rubber at various points solely within the country for distribution to foreign nations. The government is responsible for distributing aid to foreign countries.

The following table displays the outcomes of the effectiveness of logistics and supply chain management, as well as the system's connection to the ASEAN area among rubber growers and distributors in Buriram Province.

**Table 1. The Efficiency of Logistics and Supply Chain Management**

Details	$\bar{X}$	SD	Level	rank
personnel management	3.13	0.76	moderate	1
market forecast	1.73	0.70	Low	3
supply chain services	1.71	0.58	Low	4
supply chain management strategy	1.74	0.65	low	2
supply chain management	1.50	0.50	Lowest	5
total	1.96	0.64	lowest	-

According to [table 1](#), the management of sensitive logistics systems received the least focus (1.96). Personnel management has been determined to have the highest average, followed by supply chain management strategy, market forecasting, supply chain services, and supply chain management. Comparing the responses to questionnaires categorized by gender using the T-test, there is no statistically significant difference at the .05 levels between the opinions of men and women. Comparing the difference with educational level using the One Way ANOVA statistic, there is no significant difference at the .05 significance level, as indicated in the following table.

According to [Table 2](#), the effectiveness of rubber logistics management in Buriram Province necessitates several improvements to accelerate the transportation system and minimize transportation costs, which can be derived from the following factors:

The general mean regarding personnel management is modest. The highest average is the shortage of qualified staff, followed by tenacity and tolerance. The characteristic of the middle mean was honesty, followed by work discipline, responsibility, skill,

workforce, problem-solving ability, computer expertise, collaboration skills, and fundamental job knowledge.

**Table 2. Compare the Differences in Opinions of Logistics and Supply Chain Management between the Educational Levels by Scheffe**

Comparison of education levels		SS	df	MS	F	P
personnel management	Between Groups	19.584	5	3.917	1.115	.352
	Within Groups	1190.904	339	3.513		
	Total	1210.488	344			
market forecast	Between Groups	85.922	5	17.184	.894	.486
	Within Groups	6519.838	339	19.233		
	Total	6605.760	344			
supply chain services	Between Groups	9.364	5	1.873	.654	.659
	Within Groups	971.322	339	2.865		
	Total	980.686	344			
supply chain management strategy	Between Groups	40.641	5	8.128	1.039	.394
	Within Groups	2651.101	339	7.820		
	Total	2691.742	344			
supply chain management	Between Groups	4.593	5	.919	.183	.969
	Within Groups	1705.177	339	5.030		
	Total	1709.770	344			

The lowest averages are inventiveness and foreign language proficiency. The overall mean is determined to be quite poor in terms of market forecasting. Following the review of the distribution, stock appreciation, and business value comes the selection of customer categories and the delivery of products to customers. The average practice was at its lowest level, i.e., focused on individual products and attention to product prices, increased customer service requirements, and market research before manufacturing. The average level of performance in supply chain services is low. The intermediate level of performance rated as poor is the supply chain service to maintain the appropriate level of inventory and to meet the customer's needs as much as possible by using an information system to link and inform the information immediately, followed by cooperation with other companies or offices to deliver products to various domestic and international markets. The lowest average level of practice is supply chain management, which

involves fostering positive relationships between corporate units and handling trade contracts, purchase orders, and trade discussions.

The average level of supply chain management plan implementation is low. Manufacturing following company procedures, such as the packing of production activities schedule, testing, packaging, and preparing for supply chain delivery, assessing the quality level, productivity, and productivity of workers, followed by the planning process and controlling of the efficient and effective logistics and the storage of the supplier's goods for the customer, is rated as low on average. The lowest mean is the use of e-commerce through the development of partner networks, the organization of systems for flexibility and adaptability, the optimal use of data through the adaptation and linking of information systems, and the improvement of the quality of the information to increase competitiveness.

In terms of supply chain management, the average level of performance is low. As each topic is examined, it is determined that the average practice rating is low for the definition of the transport network and the emphasis on the need for service, strategies development of effective supply chain technology, such as electronic trading or using a website to advertise their products for international delivery services. The lowest practice average includes customer categorization, market demand survey, de-demand dynamics analysis, management of raw materials to decrease costs, performance evaluation of supply chain linkage, and profitability evaluation at each stage.

Problems in logistics and supply chain management are as follows:

**Table 3. Problems in Logistics and Supply Chain Management**

Details	$\bar{X}$	SD	level	rank
Problems with Legal and regulatory logistics	4.00	0.70	High	4
Infrastructure problems	2.11	0.69	Moderate	5
Problems in information systems and logistics databases	4.39	0.75	High	3
Problems with personnel and logistics knowledge	4.46	0.59	High	2
problems of development of logistics service providers	4.58	0.63	most	1
Total	3.91	0.67	High	-

According to [Table 3](#), the overall problems in logistics system management are rated at a high level (3.91). Still, in each detail, the issues in the development of logistics service providers are the most prevalent, followed by personnel and logistics knowledge, information systems and logistics databases, legal and regulatory issues in logistics, and infrastructure issues, respectively. For evaluating this issue, the researcher compares

opinion data using T-Test and finds no significant difference in opinions at the.05 levels; similarly, when comparing opinions with educational level using One Way ANOVA, the researcher finds no significant differences at the.05 level, as shown in the table below.

**Table 4. Compare the Differences in Opinions of Problems in Logistics and Supply Chain Management between the Educational Levels by Scheffe**

Comparison Details of Education Level		SS	df	MS	F	P
Problems with Legal and regulatory logistics	Between Groups	33.066	5	6.613	2.419	.036
	Within Groups	926.608	339	2.733		
	Total	959.674	344			
Infrastructure problems	Between Groups	76.365	5	15.273	.596	.703
	Within Groups	8686.596	339	25.624		
	Total	8762.961	344			
Problems in information systems and logistics databases	Between Groups	153.972	5	30.794	.872	.500
	Within Groups	11966.875	339	35.301		
	Total	12120.847	344			
Problems in information systems and logistics databases	Between Groups	20.353	5	4.071	.577	.717
	Within Groups	2390.266	339	7.051		
	Total	2410.619	344			
problems of development of logistics service providers	Between Groups	30.831	5	6.166	.663	.652
	Within Groups	3153.120	339	9.301		
	Total	3183.951	344			

According to [table 4](#), the researcher wishes to summarize the issues with the management of the rubber logistics system for ASEAN export in Buriram Province as follows:

Regarding legal and regulatory issues in logistics, the overall mean problem is at a high level. However, when each detail is considered, it is found that the mean of the issues rated at the highest level was the lack of laws for governing and promoting businesses, such as the law of truck weight and height, which did not favor the efficient transport of operators, and laws/regulations/regulations related to the importation and export of various departments, which impeded el

Regarding infrastructure issues, the overall mean problem situation is graded as moderate. As each element is reviewed, it is determined that the moderate challenges are the capacity to deliver goods from Buriram to various sites of purchase, technology issues,

developing trade networks, improving legislation and the logistics supply chain, and the effectiveness of Thai trade facilitation. The main port of Thailand is considered only the destination port, where feeder ships pick up and transfer goods to the Singapore port on the main trade routes. Road efficiency and rail transportation inside Buriram Province connect to ASEAN countries.

The average number of issues is considerable concerning information systems and logistics databases. As a result of a thorough examination, it was determined that the moderate problem is at its highest level, i.e., the government lacks policy and support for IT Service Providers in the Thai private sector to compete with foreign countries, lack of support for the adoption of information technology in small and medium-sized enterprises, inefficiency of IT Infrastructures & Network-ing for speed, and non-development of software and information technology.

The problem's mean is assessed at a very high level in terms of human and logistical understanding. As each detail is examined, it is determined that the root of the problem is at the highest level, i.e., a lack of professional training courses with the same standard, a lack of logistic personnel to support being a hub and reduce costs, a lack of personnel with the ability to transfer knowledge and training courses, and a lack of Thai service providers with the logistical capacity to compete internationally.

The greatest problem characterizes the problem of people and logistics knowledge. As each detail is considered, it is determined that the average level of the problem is the highest, such as the lack of logistics business Laws, the un-clearing of business operations, the lack of networks in connection with foreign countries, the lack of preferential promotion for assisting, the lack of customer understanding of the logistic system, and the lack of bank understanding of logistics business operations.

The majority of rubber is sold to middlemen/government agencies (98.26%), according to an analysis of the logistic costs and the connection of Buriram's rubber growers and distributors to the ASEAN area. They sent products for sale at the purchasing points of Nong Khai Province (0.58%), Mukdahan Province (0.29%), and Nakhon Phanom Province (0.29%), in that order. Most of the vehicles were trucks. The cost of logistics and supply chain systems is listed in the table below.

Guidelines for optimizing the logistics system and the rubber supply chain are found as follows;

## **5.2 Logistics Management**

Due to external pressures and competition, operators must create more contemporary logistics management. For them to be competitive, they must undergo self-improvement, such as creating industrial logistics systems and incorporating a collaborative mindset in logistics.

**Table 5. The Cost of Logistics and Supply Chain**

<b>Logistics costs (per 1 way round trip)</b>	<b>Buriram-Nong Khai</b>	<b>Buriram-Muk-dahan</b>	<b>Buriram-Nakhon Phanom</b>	<b>Establishments/Central Market/Government Agencies</b>	<b>Buriram-Chon-buri</b>
used car	truck	truck	truck	truck	truck
Oil tank (liter)	200-600	200-600	200-600	200-600	200-600
Distance from Mueang Buriram District	371 km.	287 Km.	379 Km.	30-60 Km.	381 km.
travel time	5 hours	4 hours	5 hours 33 minutes	30-70 minutes	5.49 hours
<b>Variable cost (per 1 car)</b>					
fuel cost (10.07 baht/1 km.)	3,751	2,890	3,817	302-604	3,837
Lubricant cost (0.38 baht/ 1km)	141	109	144	11-23	145
Cost of changing tires (Baht) 1.62/km	601	465	614	49-97	617
Damage insurance cost (Baht) 0.53/km	197	152	201	16-32	202
Cost of car repair and maintenance (Baht) 1.60/km.	594	459	606	48-96	610
Total variable costs (Baht)	5,283	4,075	5,382	426-852	5,410
<b>Fixed cost (per 1 car)</b>					
Staff cost (baht) (per way per person) (2.87 baht/1km)	1,065	824	1,088	86-172	1,093
Car insurance costs and fees (0.47 baht/1km)	174	135	178	14-28	179
Depreciation cost (2.60 baht/1km)	965	746	985	78-156	991
office expenses (2.01 baht/1 km.)	746	577	762	60-121	766
Total fixed cost (Baht)	2,949	2,282	3,013	239-477	3,029
Include all costs if self-delivery	8,232	6,357	8,395	665-1,329	8,439
Multiply by 2 times the price of the middleman	16,465	12,714	16,790	1,329-2,658	16,878

\* Point of purchase means the point of purchase for delivery to foreign countries. The countries that will be sent include Indonesia, Myanmar, Laos, Cambodia, Vietnam, Malaysia, the Philippines, Singapore, and Brunei.

Note: Compare the running distance from [Planning \(2011\)](#).

Thailand's logistics system is categorized as Transportation base logistics at the basic level. The primary focus of logistics is the creation of physical infrastructure (Physical / Hard Infrastructure). To respond to the genuine competitiveness of other nations, emphasis must be placed on creating a business strategy for infrastructure development, such as high-speed trains and others. Additionally, the train system must be expanded. It should significantly improve the water and coastal transport system, as this is the true evolution of transportation.

### **5.3 Reducing transportation costs**

Creating a network via Facebook or Line, etc., to link the distribution of products to the ASEAN region to transport rubber to various places at the lowest possible cost. It should lessen the administrative load.

### **5.4 Linking of rubber sales to ASEAN**

Because it is a market with the same production base, it must prioritize the free movement of commodities, services, investment, capital, and skilled labor, as well as the liberalization of various service sectors and the logistics sector.

It emphasizes the implementation of competitive policies, infrastructure development, intellectual property protection, ICT development, and energy to boost competitiveness. Government should seek to encourage the involvement and growth of SMEs, provide New Member Assistance (CLMV) to close the gap in development levels and prioritize an equitable economic system. Government should prioritize establishing free trade agreements and Closer Economic Partnerships with key trading partners to facilitate rubber distribution, which is the perfect example of integration into the global economy.

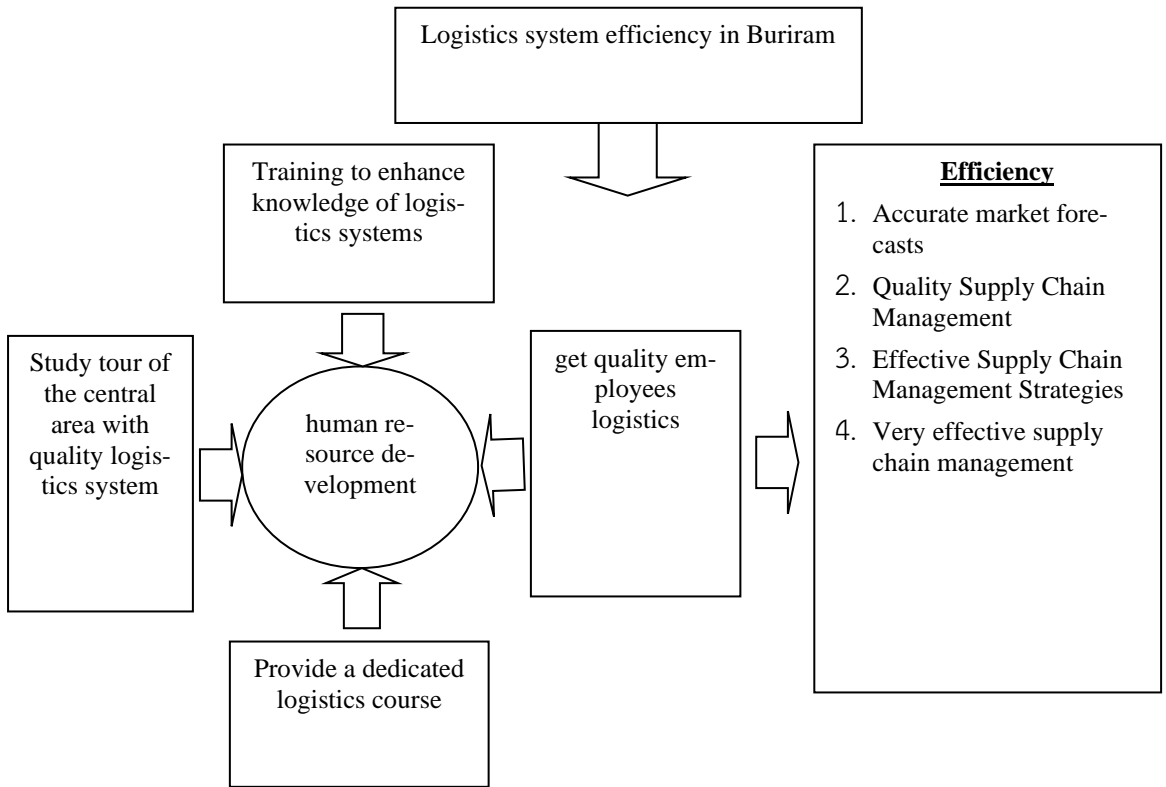
## **6. DISCUSSION, CONCLUSION**

The researcher would like to examine the following findings from the cited study:

Based on the first objective's study findings, it was determined that the current Thai logistics system uses trucks solely for transportation. There are no modern technologies for moving greater amounts for other transit routes, such as trains, aircraft, etc. The truck's efficiency can be improved based on the research findings. The middle level of logistical management is the mean. This shows that the present logistics and supply chain management systems are inefficient. Personnel development should therefore be the top concern. According to the Council of Marine Goods Exporters of [Thailand \(2006\)](#), the advantage of supply chain management must focus on human development through strengthening the leadership and competitiveness of supply chain members.

These findings are compatible with this statement. To the National Economic and Social Development Agency ([\(NESDB\) \(2014\)](#)), transportation costs will increase if personnel lack knowledge and awareness of the supply chain system. Therefore, the findings of

this study indicate that the starting point of development or supply chain management is the emphasis on personnel development, which can be synthesized into the following model for development in Buriram Province:



**Picture 2:** Flowchart of Rubber Logistic Efficiency

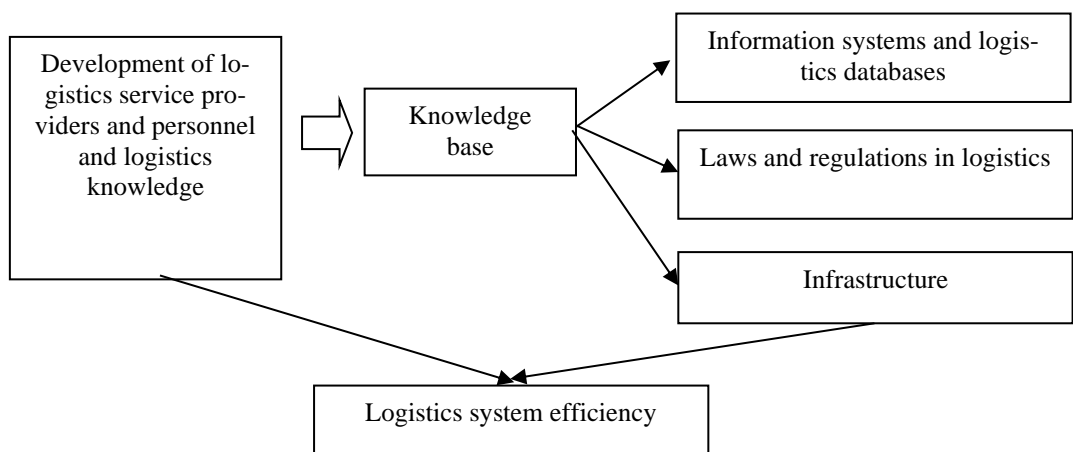
Based on this flowchart, if entrepreneurs promote and develop their personnel in the following-ing, Knowledge enhancement of logistics systems and take them to study the work or a specific logistics training course or recruit the qualified logistics staff including a systematic practice experiment, it will increase the efficiency of their logistics system, market forecasting, and supply chain management. This is to minimize costs and enhance long-term profitability, which is compatible with the writings of [Sorat \(2007\)](#), who stated that the challenge of logistics manpower development is the lack of logistics personnel with knowledge and competence at both the operational and planning levels. Other elements that must be developed include the following:

In the problem of logistics and supply chain management, from the research results, it is found that the most common problem is the development of logistics service providers, personnel, and logistics knowledge. In these problems, If the entrepreneurs increase their

knowledge or develop more potential, they will make more the efficient of the rubber logistics system in Buriram, which can be written clearly according to the model below as follows;

**Table 6: Detail of Improvement in Each Part**

Detail	Improvement
personnel management	Emphasis on personnel development to have knowledge and potential
market forecast	Emphasize estimating the sales volume and analyzing the direction of the stock's value and the added value of the business
supply chain services	Emphasize supply chain management by maintaining the inventory at an appropriate level and meeting customer needs as much as possible using the linked information systems.
supply chain management strategy	Emphasis on quality production and ability to schedule all production activities, testing, packing, and preparation for the delivery of the supply chain, assessing the quality level, productivity, and productivity of workers consistently
supply chain management	Emphasis on determining the transport network, service needs, profitability of other customers, differentiation of products that are close to customers



**Picture 3: Model of the Improved Knowledge**

According to the findings of this study, the development of the logistics system should include the development of logistics service providers and personnel with perfect

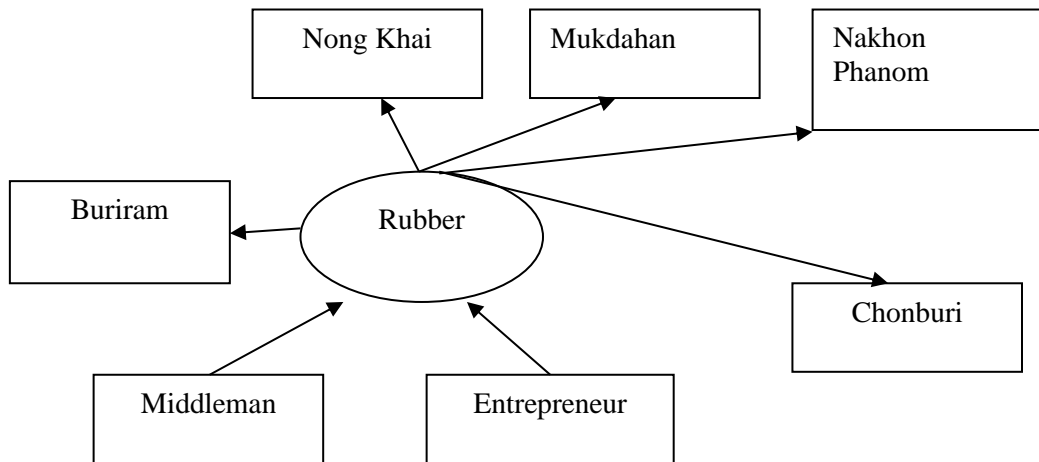
logistics knowledge, quality courses emphasizing the knowledge of information systems and logistical databases, comprehensive laws and regulations, and infrastructure for transporting consumer goods. Even though there is only one truck-based logistics system, if workers are competent at every stage, rubber growers and distributors in Buriram will be able to minimize costs and enhance revenues in the transfer of goods.

The abovementioned findings are consistent with those of [K. W. e. al \(2014\)](#), who demonstrated in their study that the rubber logistics system should be developed until the production process, and tire quality reaches the destination so that the buyer receives it correctly. The seller obtains a low-cost, high profit. It is also consistent with the research of [Suklim \(2013\)](#), which demonstrated that in developing a logistics system, one must first examine the problem's condition and then proceed to its resolution, particularly concerning production process and personnel management issues, etc. However, the following aspects of the subtleties require improvement:

**Table 7: Detail of Improvement in Each Problem**

Details	Improvement
Development of logistics service providers	The development of conducive laws for the logistics business causes unclear business operations and hinders the development of Thai logistics operators
Personnel and logistics knowledge	Should develop the vocational training courses that are the same standard and the shortage of logistics personnel to support being a hub and reduce costs
Information systems and logistics databases	The government should have a policy to support the IT Service Providers of the Thai private sector to compete with foreign countries. It should increase the efficiency and the speed of IT Infrastructures & Networking.
Laws and regulations in logistics	Laws to regulate and promote business should be improved.
Infrastructure	Infrastructure efficiency should be improved for delivering goods from Buriram to various purchase points.

In examining the cost of logistics systems, it has been shown that if business owners carry their goods from Buriram province to various distribution sites for shipment to ASEAN nations, they incur a cost of 5.3. Point 1 is the Central Market/Government Buying Center in Mueang Buriram District, and point 2 is Nong Khai Province, point 3 is Mukdahan Province, point 4 is Nakhon Phanom Province, and point 5 is Laem Chabang Port in Chonburi Province. There are two methods of conveyance: Method 1, they transport it through an intermediary, and Method 2, they transport it on their own, which can be represented as follows.



**Picture 4:** Transportation Way

According to the findings of this study, the majority of respondents chose to transport their rubber through middlemen/government agencies, which will then deliver the rubber to the purchase point in Nong Khai Province (98.26%), Bangkok (0.58%), Mukdahan (0.2%), and Nakhon Phanom (0.2%), respectively. Because transporting things to different locations is quite expensive. Therefore, the decision to utilize the services of a middleman is one approach for entrepreneurs to decrease costs. However, when the cost of self-transportation is considered, it is less expensive. Entrepreneurs must spend on the acquisition of trucks for transportation. As the cost of owning a car is evaluated, it is determined that the overall cost of carrying rubber from the province of Buriram to various points of purchase is low. Transportation to the purchase site in Buriram costs 665-1,329 baht, to Nong Khai province, 8,232 baht, to Mukdahan province, 6,357 baht, to Nakhon Phanom at Chonburi Province, 8,395 baht, and Laem Chabang at Chonburi Province, 8,439 baht. However, business owners must evaluate the value of the selling price in each place. Because if the entrepreneur sells to Buriram, even though the transportation cost is practically the lowest, the selling price of rubber may differ from selling to Mukdahan, Nakhon Phanom, Nong Khai, or even Laem Chaem Chaem. [Center \(2011\)](#), who studied logistics and rubber transportation management in the Northeastern region 2011, discovered that rubber transportation from the Northeastern part was still popular from Nong Khai Province to Bangkok Port or Laem Chabang Port because it has the lowest cost, which is approximately 14,000 baht from Nong Khai - Laem Chabang Port. However, according to this study, travel from Buriram to Laem Chabang Port will cost 8,439 baht, whereas utilizing a middleman will cost 16,878 baht. However, the price fluctuations of rubber are influenced by global market pricing, government regulations, and the purchasing market, which includes intermediaries.

Consequently, the analysis of the transportation and distribution system of rubber will help reduce costs. Logistics personnel is required to assist in the investigation, as proposed by the researcher's research results, which are consistent with [Siriwan \(2014\)](#), who stated in his article on the cost and return of rubber planting that entrepreneurs should emphasize transportation costs to increase the efficiency of rubber planting. It is also compatible with the research findings of [Thiamthetkaew \(2015\)](#), who described the selection of the distribution point as a significant factor in rubber exports. Consequently, rubber distribution is dependent not only on transportation but also on the price analysis at various locations of purchase.

For the guidelines for optimizing the rubber logistics system, the concept collection and interviews yielded the following suggestions: 1) it should focus on the development of logistics system management and establish a network to support each other in the rubber and transportation business; 2) it should analyze the physical infrastructure and create a business plan covering the rubber business from upstream, midstream, and downstream; and 3) it should focus on the development of a network to support each other in the rubber and transportation business. This is congruent with the research findings of [Kitthong. \(2013\)](#), who stated that entrepreneurs must effectively manage the logistics system, particularly the collaboration amongst rubber suppliers, to negotiate the export of rubber to other countries. The government should take the following steps: 1) It should develop transportation infrastructure to enter the competition and be able to transport goods more conveniently, such as the development of high-speed trains to connect with neighboring countries for goods transport and being the center of ASEAN, which the logistics system will give the country an advantage; and 2) It should focus on the opening of free trade agreements and economic alliances (Closer Economic Alliances).

## 7. RECOMMENDATIONS

### 6.1 Recommendations for Implementation

The following recommendations will be forwarded to ASEAN by the corporate and public sector agencies responsible for overseeing the Thai logistics system.

It should be a course on rubber logistics systems and provide training on logistics management systems so that rubber producers can examine and apply them efficiently.

It should be a promotion or establishment of a rubber plantation fund for farmers. An announcement should be prepared to manage the proper price level of rubber to be provided at the point of purchase in Thailand.

It should enhance land routes, construct a high-speed train to reduce transportation costs, and connect sales to the ASEAN market by partnering with ASEAN nations to expedite delivery.

## 8. Recommendations for the Next Research

Research should be conducted with major industrial producers in Buriram Province to analyze the rubber transportation cost using that industry's vehicles.

It should make the research on "Developing of logistics management skills for rubber entrepreneurs in Buriram Province."

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