EVALUATION OF CROSS-BORDER TRADE AND TRANSPORT RELATED STUDIES AND RECENT SITUATION AT THE FOURTH THAILAND-LAO PDR FRIENDSHIP BRIDGE (CHIANG KHONG-HOUAYXAY)

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Research Title	EVALUATION OF CROSS-BORDER TRADE AND TRANSPORT RELATED STUDIES AND RECENT SITUATION AT THE FOURTH THAILAND-LAO PDR FRIENDSHIP BRIDGE (CHIANG KHONG-HOUAYXAY)
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ABSTRACT

The fourth Thai-Lao Friendship Bridge (Chiang-Khong – Houay-Xai) is the cooperation project among Thailand, Lao PDR, and China to increase the trade facilitation performance along R3A route. Previously, the border trades and travelers were using Buk port and Chiang-Khong port as the main transportation route across Mekong River between Thailand and Lao PDR. Since the fourth Friendship Bridge was started operation in the end of 2013, the volumes of transportation activities are dramatically increase. Therefore, the objectives of this study were reviewed the forecast performance of the 1st, 2nd, 3rd, and 4th Thai - Lao Friendship Bridge. Secondary data of import and export value, number of vehicles and passengers are compared for measuring the transportation characteristics of the fourth Thai - Lao Friendship Bridge. In addition, the forecast trends in the past are compared to evaluate and identify the accuracy of the previous researches related with the border transportation across Mekong River.

However, the characteristics of trade and transportation in all four Friendship Bridges are concerned to clarify the transportation trend of the fourth Thai - Lao Friendship Bridge. The results are presented that the border transportation demand at Chiang-Khong is not as high as the forecast data. It constantly increases similar to the first Friendship Bridge at Nong Khai. Moreover, the characteristic of Chiang-Khong border is different from other bridges. The other bridges are used for serving the industry; Chiang-Khong Bridge is mostly use as an important transportation route for agriculture goods which has lower marginal cost than the industry goods. Consequently, the research of cross border transportation at the fourth Thai - Lao Friendship Bridge should consider different types of goods and characteristics of transportation for each border check point.

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Chatchanapa Ploysri

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CHAPTER 1
INTRODUCTION

1.1 Background

Nowadays, transportation and logistics play a key role in national economic development. Regarding Thailand, the central of Southeast Asia, transportation and logistics are also considered a significant part in economic development due to the connected borders to several countries. R3A Road Project is one of the major transportation linkages in Greater Mekong Subregion (GMS) by connecting Thailand, Lao People's Democratic Republic (Lao PDR) and China together. This route starts from Chiang-Khong connecting Bo Kaew, Luang Nam Ta, Bo Then in Lao PDR, Bo Han, Jing Hong in Xishuangbanna and ends at Kunming in Yunnan region, China. Chiang-Khong is a district of Chiang-Rai province in northern Thailand. This city is a cultural tourist attraction including traditional architectures. Moreover, Chiang-Khong has an important role in facilitating transportation and cross-border trade. Chiang-Rai is strategically defined as a border trade area for promoting trade, investment, and tourism to connect GMS with AEC (ASEAN Economic Community). Moreover, Chiang-Khong is also the important strategic point for supporting the border trade of Thailand. Therefore, R3a road project helps encourage ability to facilitate all the commerce and business between the border areas.

Furthermore, the fourth Thai-Lao Friendship Bridge was completely constructed and operated in the 11th of December, 2013 to enhance the transportation between Chiang-Khong, Thailand and Lao PDR. Thus, Chiang-Khong has been considered as the Distribution Center (DC) for the transportation activities including import and export of goods and services within the R3A. Nowadays, international transportation in the upper Mekong river area can be mainly divided into two ways, which are water transportation and road transportation along R3A

route. R3A route was fully operated in March, 2008. It links between southern of China (Kunming), Lao PDR, and Thailand. One of R3A route links Bangkok to Kunming with the approximately distance 1,800 kilometers. Almost 240 kilometers of this route is located in Lao PDR. Due to R3A route has been constructed from the collaboration between three countries thus Thailand and China decided to build fourth Thailand-Lao PDR Friendship Bridge which is located in Chiang-Khong district to link R3A route with Thailand as fast and as possible.

The fourth Thai-Lao Friendship Bridge is an important part for supporting international transportations and supporting AEC in 2015. Thus, this research aims to review the previous study of trade, transportation, and number of the travelers for evaluating the growth rate of the fourth Thai-Lao Friendship Bridge and the others. Moreover, to increase the growth of economy along border areas, it is important to increase the credibility from the neighbor countries. Thus, the studies of trends at other Thai-Lao Friendship Bridge will bring the facilitation of a service among the countries along Mekong River. In consequence, the outcome of this study will be used as an indicator to compare the performance of the fourth Friendship Bridge with the others. As a result, this study aims to analyze the growth rate of the 1^{st},2^{nd}, and 3^{rd} Thai-Lao Friendship Bridge from the previous studies whether these will be the evaluation basis for the 4^{th} or not. Moreover, this study aims to evaluate which methods can be applied for the next future work.

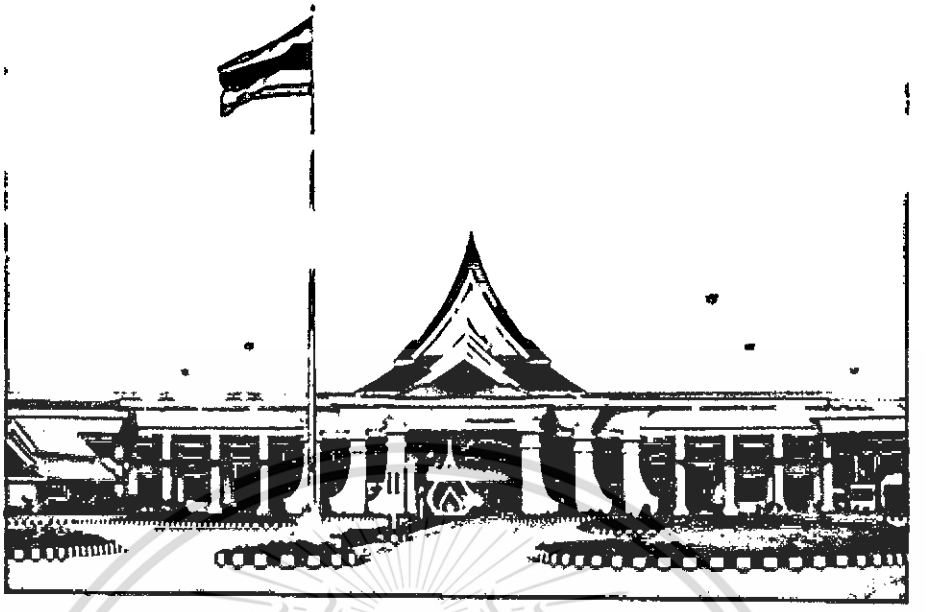

Figure 1-1: The 4th Thai-Lao Friendship Bridge border checkpoint

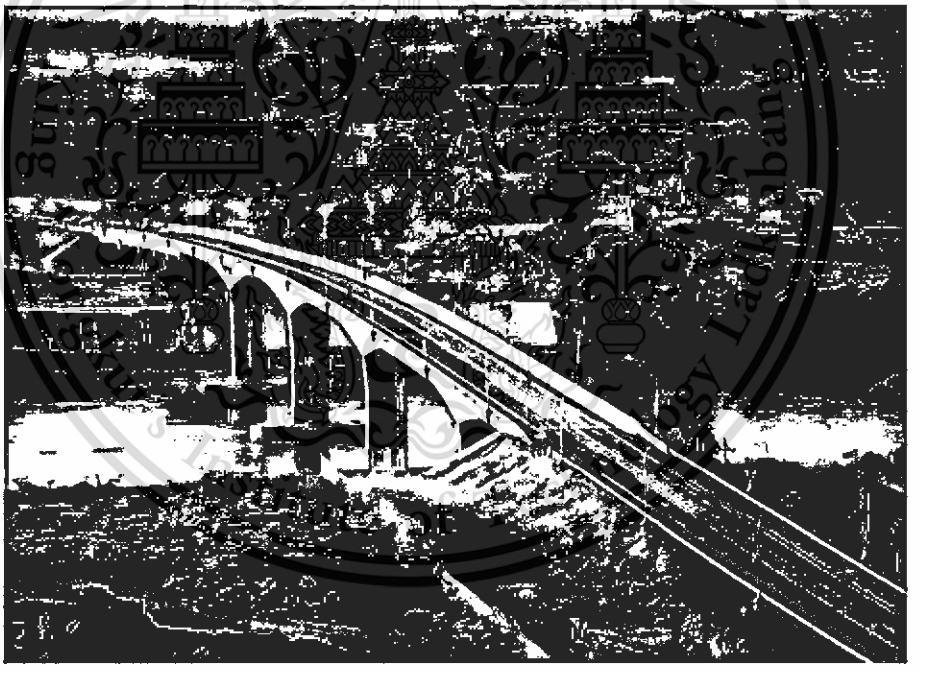

Figure 1-2: The 4th Thai-Lao Friendship Bridge

Source: http://www.dailynews.co.th/Content/economic

From the above reason, Chiang-Khong has an advantage in terms of location, which can connect with a number of countries within the region. The values of import-export among Thailand, Lao PDR, China, and Myanmar from year 2008 to 2012 are shown in Table 1-1. This table presents the value of cross border trade and transit trade within "Economic Quadrangle" in the upper Mekong region. In addition, this table shows that the total value of trade between three countries tends to increase continuously from year 2008 to 2012.

Table 1-1: Import-export values (Million Baht) among Thailand, Lao PDR, China, and Myanmar from year 2008 to 2012

Year	Thailand-China			Thailand-Lao PDR			Thailand-Myanmar		
	Import	Export	Total	Import	Export	Total	Import	Export	Total
2008	670,343	532,319	1,202,662	20,572	58,392	78,964	112,426	43,859	156,285
2009	586,143	548,760	1,134,903	15,944	56,045	71,989	95,976	52,652	148,628
2010	775,391	678,632	1,454,023	23,936	67,606	91,542	90,000	65,631	155,632
2011	930,826	791,212	1,722,039	34,489	83,534	118,023	106,511	85,880	192,391
2012	1,160,449	829,848	1,990,297	38,682	110,802	149,485	114,820	96,524	211,344

Furthermore, table 1-2 presents the statistical data of import and export values at the permanent cross border in Chiang-Khong. From year 2003 to 2012 the value of import and export considerably increased. The value of import gained from 184.6 to 3,344 million baht in year 2003 to 2012. The value of export also has a large increased from 532.2 to 10,298.9 million baht in year 2003-2012. It implies that this border checkpoint plays an important role to support the trade among the region. Moreover, the increasing of import and export value can create huge benefit for Thailand in term of economic development.

Table 1-2: Trade volumes of import-export at the cross border in Chiang-Khong from year 2003 to 2013

Year	Import value (Million Baht)	Export value (Million Baht)
2003	184.6	532.2
2004	270.1	533.3
2005	413.6	902.0
2006	587.5	1,125.5
2007	783.8	838.0
2008	956.7	1,317.0
2009	986.3	1,931.0
2010	1,731.3	3,206.8
2011	2,268.3	5,931.1
2012	3,071.1	9,453.7
2013	3,344.0	10,298.9

Source: Chiang-Khong Customs (2013)

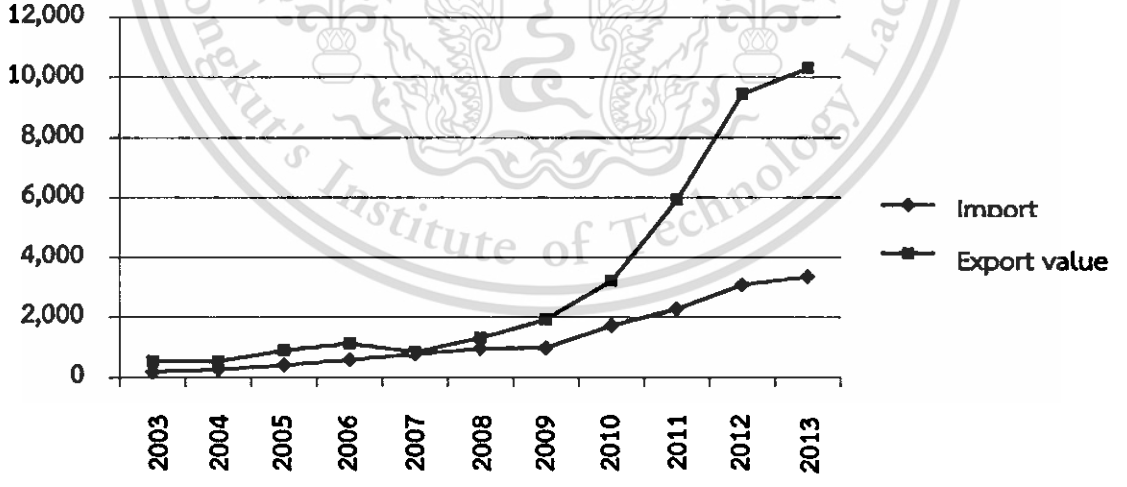

Figure 1-3: The trend of expanding import and export value at the permanent cross border in Chiang-Khong from year 2003 to 2012

According to Figure 1-3, the trade value of import and export from year 2003 to 2008 remained stable. From the statistical information of transportation activity in the community, it clearly points out that the import, export, and other activities between cross border are increasing year by year. Afterwards, in 2009 the value of import increased sharply and the value of export increased continuously until 2013. The value of import and export were increasing continuously as in year 2008, the R3A route was developed in Lao PDR. Since the completed construction, this route helps increase potential of import and export value especially in road transportation. The growth of trade and transportation in Chiang-Khong as mentioned above should be concerned for the future development because of the fourth Friendship Bridge, which is located in Chiang-Khong, can facilitates travelers to have more convenient to import, export, and travel among the region.

1.2 Problem Statement

Nowadays, international trade volume and freight transportation at the border of Chiang-Khong are growing continuously. The border trade is one of the important sections for economic development in Thailand. Thailand and Lao PDR has been trading and transporting between each other for a long time. However, the development of the fourth Thai – Lao Friendship Bridge in 2013 significantly affected the trade among Mekong River. The studies of the governmental institutes are developed to measure the effect and trend of transportation at this border. Most of the studies forecasted that the trade at Chiang-Khong border will dramatically increase due to the fully operatated of the fourth Thai – Lao Friendship Bridge. However, the actual data of transportation at Chiang-Khong border checkpoint are quite different from the forecasted data. In order to identify the accuracy of the forecasting data in previous researches, the resulting data is needed to be compared with the actual data of Chiang-Khong Bridge. Moreover, the fourth Thai – Lao Friendship Bridge just operated for one and a half years. Thus, the identification of

transportation trends will be able to support the development in terms of preparation strategies and plans for supporting the development throughout the bridge.

1.3 Objectives of the Study

Since the cross border trade across Thai – Laos border is important for supporting the economic growth among the region, the study of cross borders are very significant to plan and improve the trade facilitation. According to this situation, it is necessary to review the service performance of Chiang-Khong border (the 4th Friendship Bridge) including number of trucks, number of vehicles, and trade values. Afterwards, compare reviewed information with existing information of other bridges at the borders (1st, 2nd, 3rd Thai-Lao Friendship Bridge) in order to identify the effective research method which is valuable from the study related to cross border trade facilitation. The objectives of the study are; firstly, to review the service performance of existing studies related to Chiang-Khong border transportation. Secondly, to review and compare the forecasted results from the previous studies of all Thai – Laos Friendship Bridges in order to identify the characteristics of the Friendship Bridges. Moreover, trends and overall transportation across Thai – Laos borders will be analyzed subsequently.

1.4 Scope of the Study

In order to identify the transportation trends and characteristics of cross border transportation, the reviewed data among all of Thai – Lao Friendship Bridges were conducted. Since, this research emphasizes on the fourth Thai – Lao Friendship Bridge at Chiang-Khong in Chiang-Rai province, the secondary data and previous researches which are related with the fourth Thai – Lao Friendship Bridge are concerned. This study aims to measure of the cross border transportation in many

perspectives including the trade and transportation area at Chiang-Khong border and other Friendship Bridges. Thus, it is necessary to review the service performance from the historical data and exiting studies of Chiang-Khong and other border checkpoints.

1.5 The Expected Result

The results are expected to describe the differentiation of transportation of each Friendship Bridge and to pinpoint the transportation direction at the Chiang-Khong border. Moreover, this research aims to provide the information of transportation and trade at Chiang-Khong border for supporting the development of trade facility at the fourth Thai – Lao Friendship Bridge.

Chapter 2

LITERATURE REVIEW

2.1 Review of Previous Study on International Transport Demand and Supply of Chiang-Khong Check Point

Import-export activities and tourism occurred in Chiang-Khong are extremely important for the improvement of Chiang-Rai's economy. The border of Chiang-Khong and Laos PDR is separated by Mekong River. Before the construction of the fourth Thailand-Lao PDR Friendship Bridge, the most important mode of transportation at the border is water transportation. Afterwards, R3A road was developed to improve the transportation among Thailand, Laos PDR and China. It was officially operated in the end of March, 2008 and it became an important transportation route among the region. It has resulted in the increasing in volume of import, export and tourism through Buk port and Chiang-Khong port.

2.1.1 The Adaptation Measurement of Chiang-Saen Port and Chiang-Khong Port for Supporting The Impact by The Increasing of Transportation Through The Fourth Thailand-Lao PDR Friendship Bridge (Port Authority of Thailand (PAT) Project)

Chiang-Khong is the important border city of Chiang-Rai province. It is known as a main part for motivating economy in Chiang-Rai and supporting the connection to the southern of China. Hence, the economy development plan of Chiang-Rai has defined Chiang-Khong as the "Logistics City" because Chiang-Khong has an advantage in terms of location which has the road connecting to China by passing through Lao PDR. In this fact, Chiang-Khong has potential to develop industry areas including industrial agriculture, complex park, and general industrial park for supporting Chiang-Rai special economic zone. Therefore, the construction of the fourth Thailand-Lao PDR Friendship Bridge (Chiang-Khong – Houei Xai) is an important part of Chiang-Khong developing plan.

The total number of arriving and departing trucks at the permanent cross border at Chiang-Khong is shown in table 2-1 and figure 2-1 which present the statistical number of trucks that transport through the border of Thailand by using ferry at Chiang-Khong port.

Table 2-1: The number of arriving and departing trucks at the border of Thailand in Chiang-Khong between years 2007 to 2013

Month	Direction	Budget Year						
		2007	2008	2009	2010	2011	2012	2013
October	Arrival	199	298	229	431	797	1,736	1,053
	Departure	199	298	229	449	806	1,701	1,801
November	Arrival	296	236	237	636	1,008	1,878	1,806
	Departure	296	236	237	689	1,068	1,898	1,975
December	Arrival	333	213	374	681	1,132	1,724	2,142
	Departure	333	213	374	679	1,119	1,745	2,237
January	Arrival	320	326	364	648	1,113	1,277	2,092
	Departure	320	326	364	700	1,232	1,365	2,345
February	Arrival	280	272	501	674	842	1,614	1,279
	Departure	280	272	501	720	925	1,333	1,234
March	Arrival	371	288	580	855	1,350	1,458	1,305
	Departure	371	288	580	1,088	1,352	1,626	1,480
April	Arrival	278	235	492	784	1,142	1,339	1,260
	Departure	278	235	492	884	1,207	1,541	1,513
May	Arrival	265	205	570	1,000	1,501	1,751	1,875
	Departure	265	205	570	1,064	1,529	1,926	2,090
June	Arrival	251	197	554	911	1,450	1,473	2,066
	Departure	251	197	554	897	1,479	1,586	2,217

Table 2-1: The number of arriving and departing trucks at the border of Thailand in Chiang-Khong between years 2007 to 2013 (Cont.)

Month	Direction	Budget Year						
		2007	2008	2009	2010	2011	2012	2013
July	Arrival	210	170	512	825	1,403	1,985	2,480
	Departure	210	170	512	876	1,449	2,137	2,854
August	Arrival	261	162	545	1,140	1,746	1,954	2,465
	Departure	261	162	545	1,207	1,812	2,016	2,176
September	Arrival	214	270	435	993	1,734	1,537	1,693
	Departure	214	270	435	1,006	1,758	1,583	1,784
Total Arrivals		3,278	2,872	5,393	10,259	15,736	20,557	23,706
Total Departures		3,278	2,872	5,393	9,580	15,218	19,726	21,516
Total		**6,556**	**5,744**	**10,786**	**19,839**	**30,954**	**40,283**	**45,222**

Source: Chiang-Khong Customs (2013)

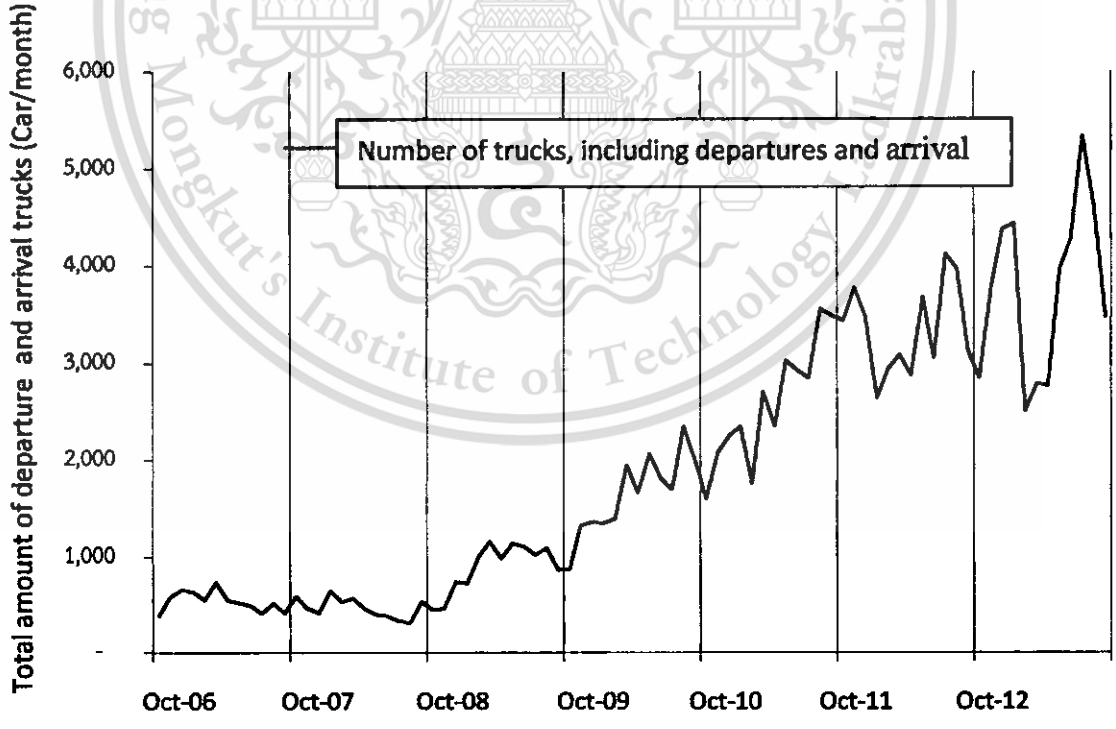

Figure 2-1: Trend of arriving and departing trucks at border of Chiang-Khong

From the table 2-1, the number of arriving and departing trucks crossing border by ferry from October, 2006 to September, 2013 are fairly close in each month because each truck usually transport their products as their schedule and return to the initiation. Figure 2-1 shows the real fact that after the improvement of R3E (R3A) route in the middle of year 2008, the number of trucks are increased continuously. From the existing data of trucks on average, including arrivals and departures are approximately 500 vehicles per month (16 vehicles per day). Up until now, the number of trucks on average, including arrivals and departures have increased to approximately 3,600 vehicles per month (120 vehicles per day) or more than 7-fold in just four years after the construction of R3E (R3A) completed. Hence, these statistical numbers of trucks are presenting the potential improvement in this route. Thereby, it is possible to expect that after the completion of fourth Thai-Lao PDR Friendship Bridge construction, the number of trucks and road transport will increase.

According to the statistical information from the survey data, the transportation of products is mostly transported by the truck from the origin to the border and then transported to Lao PDR by the water transportation. However, when the fourth Thailand-Lao PDR Friendship Bridge finished, the water transportation procedure will be substituted by the road transportation through the Friendship Bridge as it has more convenience and safeness. Consequently, after the fourth Thailand-Lao PDR Friendship Bridge opened on 11 December 2556, it directly affected on the operation of the port of Chiang-Khong. For example, Lao PDR moved all customs and the other formalities from the port to the fourth Thailand-Lao PDR Friendship Bridge. As a result, almost freight activities at the port were moved to the bridge. After the official opening of the bridge for 6 months, they got a good feedback from the travelers. However, some kinds of the transportation are still operated through the Port of Chiang-Khong.

Base on trade value and freight transportation passing through Chiang-Khong customs, it was forecasted for year 2019 that they will be expanded to 1.85-2.25 fold or approximately 2.7-3.4 billion baht per year. Moreover road transportation cross

border at fourth Thailand-Lao PDR Friendship Bridge will be more important for logistics and economic system of Thailand.

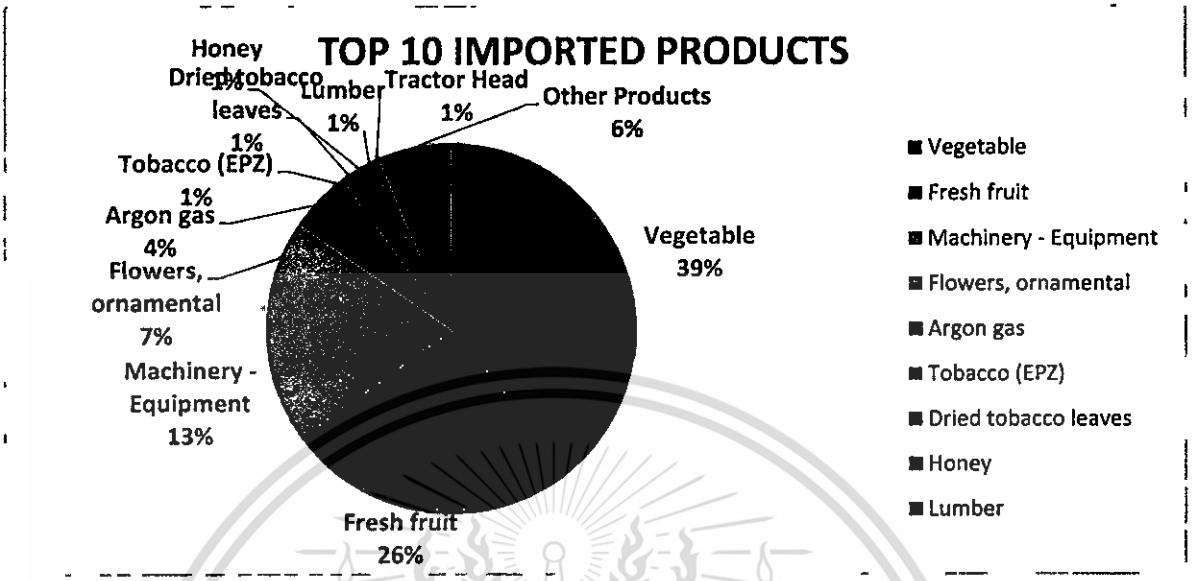

Figure 2-2: Ranking of Ten Imported Products at Chiang-Khong in Year 2014

Source: Chiang-Khong Customs (2014)

The imported value in year 2014 at Chiang-Khong was equal to 3,285 million baht. According to the ranking data, the products have varieties of categories including vegetable, fresh fruit, machinery-equipment, flowers and ornaments, argon gas, tobacco, dried tobacco leave, honey, lumber, and tractor head respectively. Moreover, the major proportion of import products is imported from China. Most of the products imported from China are fresh goods such as vegetable, fruit, and flower which have a short shelf life. This pie chart showed that more than a half of all trade value accounted in the first two product types including vegetable (39 percent) and fresh fruit (26 percent). In addition, rank 7th to 10th are imported from China and Lao PDR which have very low trade volume when comparing to the rank 1st to 6th products from China.

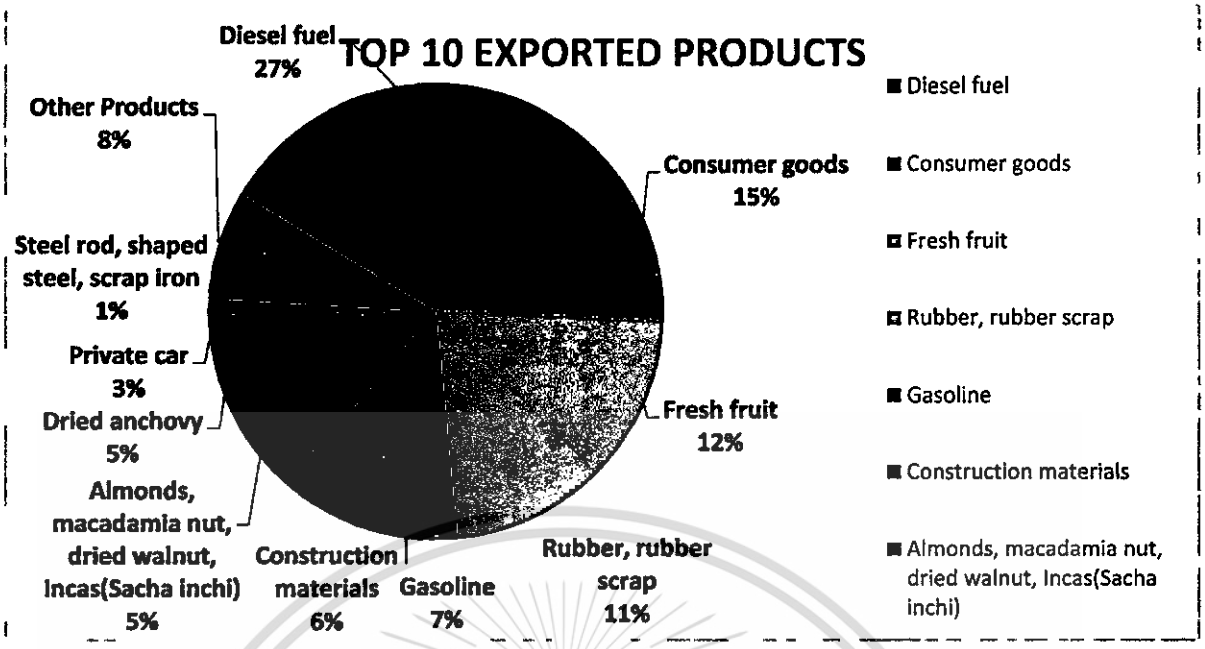

Figure 2-3: Ranking of Ten Exported Products at Chiang-Khong in year 2014

Source: Chiang-Khong Customs (2014)

From the figure 2-3, the top ten ranking of exported have the trade value up to 11,992 million baht. Since Chiang-Khong is an important gate for transporting goods from Thailand to other countries, the value of export is triple time more than the value of import. The destination of transportation among Chiang-Khong is China, Lao PDR, and Myanmar. Majority of exported products are consumed by China and Lao PDR consumers. The goods can be divided into 4 types which are fuels, consumption goods, material resources, and automobile. Furthermore, a half of the margin is the fuels with 27% of diesel and 7% of gasoline. Almost all products exported passing through the Chiang-Khong customs are the products that have heavy weight and high volume. Thus, the fourth Thailand-Lao PDR Friendship Bridge and the R3A road are important to improve mobility and trade volume within the region.

- Development of a model to predict the amount of product in the future (2013-2017)

In order to predict the amount of product in future, the analysis based on the amount and type of goods in the present is required for planning and developing the marketing plan of Chiang-Saen port and Chiang-Khong port in the future.

Econometric Model with the infrastructure of the equation is employ in this study in order to predict amount of product transport in the future period. This method is most widely used to study the pattern of international trade. The model used in this study has been developed and improved by the Asian Development Bank (ADB).

Econometric model of ADB is mathematical equation that represents the relationship of trade with the factors that affect the volume of trade. The affected factors can be divided into two types which are the factors that show demand and supply of international trade and the factors that represent barriers of international trade. The factors in this model are selected from parts of the new international economic theory. The model used in this study is shown in equations (1) and (2).

$$X_{ijt} = AY_{it}^{\alpha_e} Y_{jt}^{\alpha_m} H_i^{\beta_e} H_j^{\beta_m} N_{it}^{\gamma_e} N_{jt}^{\gamma_m} K_{it}^{\eta_e} K_{jt}^{\eta_m} L_{it}^{\lambda_e} L_{jt}^{\lambda_m} G_{it}^{\sigma_e} G_{jt}^{\sigma_m} W_{it}^{\rho_e} W_{jt}^{\rho_m} D_{ij}^{\Phi} (\varepsilon_{ijt} + u_{ij}) \quad (1)$$

Where; X_{ijt} = Export volume of the country (i) to (j) in time (t)

Y_{it}, Y_{jt} = GDP of the country (i) and (j) in time (t)

H_i, H_j = Area of the country (i) and (j)

N_{it}, N_{jt} = Population of the country (i) and (j) in time (t)

K_{it}, K_{jt} = Tariffs of the country (i) and (j) in time (t)

L_{it}, L_{jt} = Transportation network across the country (i) and (j) in time (t)

G_{it}, G_{jt} = Domestic transportation network in the country (i) and (j) in time (t)

W_{it}, W_{jt} = Direct investment into the country (i) and (j) in time (t)

D_{ij} = Distance between the capital of the country (i) and (j) in time (t)

$\varepsilon_{ijt}, u_{ij}$ = Error terms

A = Constant

- Estimated Coefficients

$$\alpha_e, \alpha_m, \beta_e, \beta_m, \gamma_e, \gamma_m, \eta_e, \eta_m, \lambda_e, \lambda_m, \sigma_e, \sigma_m, \rho_e, \rho_m, \Phi$$

However, a lot of estimated coefficients from equations are not in form of linear equations as they are difficult to solve. So, the economists usually convert the equation into a log-linear equation as follows:

$$\ln X_{ijt} = \ln A + \alpha_e \ln Y_{it} + \alpha_m \ln Y_{jt} + \beta_e \ln H_i + \beta_m \ln H_j + \gamma_e \ln N_{it} + \gamma_m \ln N_{jt} + \eta_e \ln K_{it} + \eta_m \ln K_{jt} + \lambda_e \ln L_{it} + \lambda_m \ln L_{jt} + \sigma_e \ln G_{it} + \sigma_m \ln G_{jt} + \rho_e \ln W_{it} + \rho_m \ln W_{jt} + \Phi \ln D_{ij} + \ln \varepsilon_{ijt} + \ln u_{ij}$$

The model is used for forecasting the volume of trade that will be increase in the Growth Effect. From the development of transportation of cross-border and transportation network within the countries of the GMS parties. The network of transportation is an importance factor to determine the flow of goods and materials. The importance trade barriers are tariffs which were considered to be decreased to 0% under the framework of the ASEAN countries.

Table 2-2: Models of international trade, it has been developed by Fujimura and Edmonds, 2006

Variables in the model	Models of international trade volumes				
	Model 1	Model 2	Model 3	Model 4	Model 5
Constants	-8.186	8.802	8.875	1.985	-0.341
Distance between the capital	1.880	-0.743			
GDP of exporting country	0.786***	0.366**	-0.155	0.078	0.586
GDP of importing country	0.447**	0.393**	-0.054	-0.302	-0.299
The population of the exporting country	1.978***		1.872***	1.732**	0.966
The population of the importing country	4.557***		1.560	3.335*	3.286**
Areas of the exporting country	-2.677		-2.333***	-2.089**	-0.459
Areas of the importing country	-6.2***		-2.183	-4.031*	-4.166**
Tax of the exporting country				-0.172	
Tax of the importing country				0.438*	
Cross border transportation network of the exporting country		0.456**	1.357***	1.465***	0.729
Cross border transportation network of the importing country		0.423*	1.577***	1.778***	2.152***
Transportation network within of the exporting country			-0.644**	-0.659**	-0.32
Transportation network within of the importing country			-0.805**	-1.361***	-1.404***
Direct investment to the exporting country					-0.274*
Direct investment to the importing country					-0.009

NOTE: The significance of coefficients are estimated by.

* Significant at the 90% confidence level.

** Significant at a confidence level of 95%.

*** Significant at a confidence level of 99%.

In interpreting the coefficients in the model, if the coefficients are positive, it means that these variables have a positive relationship with the dependent variable.

It results in an expansion of bilateral trade between countries. In addition, if an independent variable increases, it means trade between two partner countries has a potential to increase as well. The size of the coefficient (Magnitude) is a measure of the impact of variables to the dependent variable. In addition, the model also shows the numeral of statistical, including a level of confidence. If confidence level is high, it means the statistical relationship between these variables and dependent variable tends to be more accurate. Normally, the statistical level of confidence is acceptable with 95 percent.

Transportation between Thailand and China usually passes through Lao PDR as the main route. The forecast had selected model 3, which is a model considered to be the integrity of the transportation network factors in the region.

Table 2-3: The forecasted expanding of international trade between Thailand- South China and Lao PDR

Partner country	Direction	Growth rate year 2019 Compared to base year (2011)
Thailand- Lao PDR	Import	100.7 percent (average 9.1 percent per year)
	Export	132.1 percent (average 11.1 percent per year)
Thailand- South China (Case 1: Growth by GDP)	Import	183.3 percent (average 13.9 percent per year)
	Export	197.5 percent (average 14.6 percent per year)
Thailand- South China (Case 2: A rapid growing)	Import	260.9 percent (average 17.4 percent per year)
	Export	278.4 percent (average 18.1 percent per year)

From table 2-3, the trend of bilateral trade between Thailand and Lao PDR is increasing around 10 percent per year. While, Thailand and South China in the case under the assumption of developed transportation network in Lao PDR is normal condition. In case 1, a growth rate is over 14 percent and if it is accordance with the assumption of the transportation network, the growth leaps in Lao PDR. In case 2, bilateral trade between Thailand and southern China may expand to 18 percent, which is considered very high level.

According to the water transportation between Thailand and southern China over the Mekong River, the infrastructure developed to support transportation in commercial port in Thailand (Chiang-Saen port) and China (Guan-Lei port) are fully operated. This assumption is based on case 2. It can be concluded that the trends of goods transportation between Thailand and southern China have an opportunity to expand to 18 percent per year (based on case 2).

Table 2-4: The expanding trend of cross border trade at Chiang-Khong from year 2014 to 2019

Year	Value of Import-Export through Chiang-Khong border[1] (million baht)					
	Case of growth based on GDP[2]			Case of growth rapidly[2]		
	Import	Export	Total	Import	Export	Total
2014	3,729	11,622	15,351	3,850	12,017	15,868
2015	4,157	13,116	17,273	4,433	14,023	18,456
2016	4,635	14,801	19,437	5,105	16,362	21,467
2017	5,169	16,703	21,872	5,878	19,092	24,970
2018	5,763	18,849	24,612	6,768	22,278	29,046
2019	6,426	21,272	27,697	7,793	25,995	33,788

Note: [1] Shows the number of this table are trade volume at Chiang-Khong border

[2] Based on the assumption that transportation between Thailand - China will transport through Laos PDR. In this study is defined in 2 cases, 1) the growth of the road network increases as the GDP of Lao PDR., And 2) the road network are growth rapid with 50% in year 2015 and 100% in year 2030

The prediction trend of trade volume at Chiang-Khong border in table 2-4 is measured by Econometric models to analyse the expanding trend from the historical data. However, in the past, the most important transportation mode at Chiang-Khong border is water transportation. The result from the models shows that, in year 2019 the trading trend will be increased from 13.6 million baht in 2013 to 27.7 million baht, in case of GDP based forecasting. On the other hand, case of infrastructure in Lao PDR is growing rapidly; it will help support the freights between Thailand and China to be faster and more convenient. Furthermore, the total trade volume will rise to approximately 22 percent when compared to the normal growth rate in this model.

2.1.2 The Study of the Detailed Design and Operation and Management of Intermodal Facilities at Chiang-Saen – Chiang-Khong, Chiang Rai Province (Office of Transport and Traffic Policy and Planning (OTP) project, 2011)

In order to support the business hub and the trade within Indochina region and to make Thailand logistics system meet international standards, Office of Transport and Traffic Policy and Planning (OTP) has studied the appropriate Intermodal Facilities Project Implementation in two ports which are Chiang-Saen port and Chiang-Khong port. Intermodal Facilities Project at Chiang-Kong is located close to the construction project of the 4th bridge across the Mekong River. This Intermodal Facilities have role to support the trade from western China. The goods transported from western China through Mekong River are shipped by using R3E (R3A) road. When the goods are passing to Thailand, it will cross the Mekong Bridge, which is under construction at Chiang-Kong. So, it is possible to shift to rail mode and transport to Pakbara port at this point. Moreover, the goods from Europe and Africa which need to be transported to Western China are shipped through the Andaman Sea at Pakbara port. After that, it will change to the Intermodal Facilities at Chiang-Saen and Chiang-Khong for changing the mode of transportation to the water transportation and passing through the Mekong River or road transport through the R3E (R3A) road to the western China.

To forecast the product volume, this project studied the development of China, especially western China. Moreover, the studied of development trend in

western China can forecast the ability to produce and develop products for export and import goods for production and development of domestic consumption.

- Forecasting of Freight Volume at Chiang-Khong Intermodal Facilities

In order to forecast volume of freight through the Intermodal Facilities, the research is proposing the following assumptions:

1. Assumption for the starting year, the year that design intermodal facilities and results of forecast of western China regions. Intermodal Facilities at Chiang-Kong is planned to operate in 2014. Although rail transportation was unavailable at that time, Intermodal Facilities at Chiang-Kong is still necessary to use as a place for changing the trailer truck to reduce congestion at the customs area.

2. Assumption in probability of freight from western China across Thailand and the probability level of service (Base Case). Calculation of the model is considered from the following possibilities:

- Origin and destination of the goods.
- Shipping liners from China operated at Pakbara port.
- To manage Pakbara port with facilitated Chinese ships and facilitated information technology (IT) to support Chinese operator in Thailand.

3. Assumption about opportunity of freight between western China and other regions through intermodal facilities. In Base Case, the study has the conditions to transport goods by using the routes through Thailand as the following:

- During year 2014-2017 (There is no railway line of Chiang-Rai – Chiang-Sean, Chiang-Rai - Chiang-Kong and China - Lao railway)

- During year 2018-2027 (There will be railway line at Chiang Rai - Chiang Saen and Chiang Rai - Chiang Khong, but without China - Lao railway)
- During year 2028-2045 (There will be railway line at Chiang Rai - Chiang Saen and Chiang Rai - Chiang Khong and China - Lao railway)

4. Assessment results of forecasted freight volumes from the assumptions.

Table 2-5: Forecasted Freight Volume at Chiang-Khong's Intermodal Facilities in Year 2014, 2018, 2028, 2032, 2041

Unit: 1,000 TEUs

Freight Volume via Chiang-Khong IF	2014	2018	2028	2032	2041
China-Thailand	175.8	268.8	571.1	721.0	1,152.2
China-Malaysia	48.7	127.7	553.9	699.2	1,117.3
China-Singapore	26.5	69.4	322.8	407.6	651.3
China-others	0.0	816.3	2,125.0	2,682.8	4,453.9
Total	**250.9**	**1,282.2**	**3,572.9**	**4,510.7**	**7,374.7**

1. Characteristics requirements are related to the evaluation of the forecasted volume of freight. Most of freights must use containers because these are the freight across the country that needs security and reliability.
2. Summarize the evaluation of forecasted the freight volumes. OTP has been forecasting the volume of goods which is transported via containers through the Intermodal Facilities at Chiang-Khong in the future.

Table 2-6: The Import and Export Volumes between Western China and Other Regions at Chiang Khong Intermodal Facility in Year 2014, 2018, 2028, 2032 and 2041

Unit: 1,000 TEUs

Year	China-Thailand (Import)		China-Thailand (Export)		China-Malaysia (Import)		China-Malaysia (Export)		China-Singapore (Import)		China-Singapore (Export)		China-others (Import)		China-others (Export)		Total
	LCL	FCL	LCL	FCL	LCL	FCL	LCL	FCL	LCL	FCL	LCL	FCL	LCL	FCL	LCL	FCL	
2014	0.27	2.47	0.78	7.03	0.08	0.74	0.21	1.90	0.07	0.67	0.08	0.76	0.00	0.00	0.00	0.00	15.06
2018	0.42	3.78	1.19	10.75	0.21	1.93	0.55	4.97	0.20	1.76	0.22	1.99	0.54	4.85	4.36	39.27	76.99
2028	0.89	8.03	2.54	22.85	0.93	8.38	2.40	21.56	0.91	8.20	1.03	9.25	1.40	12.64	11.36	102.23	214.60
2032	1.13	10.13	3.20	28.84	1.18	10.58	3.02	27.21	1.15	10.35	1.30	11.68	1.77	15.95	14.34	129.07	270.90
2041	1.80	16.19	5.12	46.09	1.88	16.91	4.83	43.49	1.84	16.55	2.07	18.66	2.94	26.48	23.81	214.27	442.93

To design the Intermodal Facilities that suit with the volume of goods for a specific time and reduce investment, the periods of development can be divided into 2 phases. The second phase will be implemented only when the volume of goods increases to a half of the forecasted volume in 30th year as following:

Chiang Khong's intermodal facility

Phase 1/1 Accommodate the volume during the first four years after opening (2014-2017).

Phase 1/2 Accommodate the volume during the next 15 years (2018-2032).

Phase 2 Accommodate the volume during the next 9 years (2033-2041).

2.1.3 The Economic, Engineering and Environmental Impacts of The Construction 4-lane Highway Network - Bridge Over The Mekong River at Chiang-Khong. (Department of Highways (DOH) project, 2009)

The Department of Highways (2009) studied traffic and transport condition on the road networks and forecasted traffic volume on roads and nearby road network. However, the result of this study took advantage of the followings:

- Physical design and geometry of the highway project.
- To evaluate the benefits of the traffic from road construction project.
- To evaluate the environmental impacts from opening road project.

From the traffic conditions on the highways network (2009), the forecasting of traffic goal has considered both with and without the road construction project to forecast the traffic volume for the highway project. The target forecasting years are:

Year 2015 Assumed open road project.

Year 2019 5 year after opened road project.

Year 2024 10 year after opened road project.

Year 2029 15 year after opened road project.

Year 2034 20 year after opened road project.

In order to create database and traffic simulation model, traffic and transportation data are required. Afterwards, traffic analysis and the future transportation will be proposed. The information of reports from relevant governmental institutes and the result of a study of the transit traffic from the past report lead to the understanding of the traffic and transportation condition. Apart from the traffic volume data, in order to get more accuracy, the information of seasonal variation is used to adjust the traffic and transportation simulation model.

The traffic assignment contributed the selected route to support the traveling demand to simulate the traveling network conditions. Furthermore, the road network simulation and the schedules of various analyses will be used to calculate the volume of traffic from the traffic assignment. This calculation applied "Capacity Restraint" to explicate the traveling situation.

The traffic and transportation simulation models are developed to forecast and analyze the future traffic conditions on the road network.

The results of the traffic conditions prediction are:

- The traffic volume on the highways especially road on the project.
- The speed of travelling on each highways route.
- The proportion of traffic volume per road capacity (v/c) on highways.
- The traffic volume per kilometer (Vehicle-Kilometer)
- The traffic volume per hour (Vehicle-Hours)

The study of DOH on future demand of traveling volume presented that the volume of personal travel is increased from 2,503,033 persons - times/day in year 2009 to 7,356,286 persons - times/day in year 2034, annual growth rate is 4.4 percent per year. Transportation of goods is increased from 36,287 tons/day in year 2009 to 81,430 tons/day in year 2034, representing a compound annual growth rate of 3.3 percent per year. The forecasted demand of travel volume to meet the year goals is shown in the table 2-7.

Table 2-7: Forecasted private and freight transportation demand

Year	Private transport (Travelers- trip/ day)	Freight (tons/day)	Growth rate (Percent per year)	
			Private transport	Freight
2009	2,503,033	36,287	-	-
2015	3,456,402	45,909	5.53	4.00
2019	4,239,559	52,384	5.24	3.35
2024	5,222,460	61,035	4.26	3.10
2029	6,310,887	70,964	3.86	3.06
2034	7,356,285	81,430	3.11	2.79

Source: Study of DOH (2009)

According to table 2-8, the travel demands on highway network - Bridge over the Mekong River at Chiang-Khong are increased from 222,437 PCU/day in year 2009 to 306,692 375,746 462,470 58,544 and 650,923 PCU/day in year 2015, 2019, 2024, 2029, and 2034 respectively. These results represent the growth rate with 4.4 percent per year.

Table 2-8: Forecasted travel volume

Year	Travel volume (PCU/day)	Growth rate (Percent per year)
2009	222,437	-
2015	306,692	5.50
2019	375,746	5.21
2024	462,470	4.24
2029	558,544	3.85
2034	650,923	3.11

Source: Study of DOH (2009)

2.1.4 The Development Border Checkpoint and Truck Fleet Performance (Department of Highways (DOH) Project, 2012)

This project studied on the economic benefit for establishing weight station at the Thai – Laos cross border. Thus, number of trucks traveling across the bridge was forecasted for measuring the volume of track at border check point. Table 2-9 presents the expected fees at border checkpoint of the fourth Thai–Lao Friendship Bridge.

Table 2-9: Expected fees at the fourth Thai–Lao Friendship Bridge border checkpoint (Chiang-Khong – Houay-Xai)

Year	Forecasted truck volume per year				Fees (Baht / year)			Total collected fees (Baht / year)
					Freight truck			
	6 wheels	10 wheels	More than 10 wheels	Total	6 wheels	10 wheels	More than 10 wheels	
2015	15,214	4,777	15,941	35,933	250	350	500	13,446,316
2016	17,081	5,363	17,898	40,343				15,096,373
2017	18,948	5,950	19,854	44,752				16,746,431
2018	20,815	6,536	21,810	49,162				18,396,489
2019	22,683	7,122	23,766	53,571				20,046,547
2020	24,550	7,708	25,723	57,981				21,696,605
2021	26,417	8,295	27,679	62,390				23,346,663
2022	28,284	8,881	29,635	66,800				24,996,720
2023	30,151	9,467	31,591	71,209				26,646,778
2024	32,018	10,053	33,548	75,619				28,296,836
2025	33,885	10,640	35,504	80,028	320	450	640	38,353,303
2026	35,752	11,226	37,460	84,438				40,466,550
2027	37,619	11,812	39,416	88,847				42,579,796
2028	39,486	12,398	41,372	93,257				44,693,043
2029	41,353	12,984	43,329	97,666				46,806,289
2030	43,220	13,571	45,285	102,076				48,919,536
2031	45,087	14,157	47,241	106,485				51,032,782
2032	46,954	14,743	49,197	110,895				53,146,029
2033	48,821	15,329	51,154	115,304				55,259,275
2034	50,688	15,916	53,110	119,714				57,372,522

Table 2-9: Expected fees at the fourth Thai–Lao Friendship Bridge border checkpoint (Chiang-Khong – Houay-Xai) (Cont)

Year	Forecasted truck volume per year				Fees (Baht / year)			Total collected fees (Baht / year)
					Freight truck			
	6 wheels	10 wheels	More than 10 wheels	Total	6 wheels	10 wheels	More than 10 wheels	
2035	52,555	16,502	55,066	124,123	410	580	820	76,272,866
2036	54,422	17,088	57,022	128,533				78,982,478
2037	56,289	17,674	58,979	132,942				81,692,091
2038	58,156	18,261	60,935	137,352				84,401,703
2039	60,023	18,847	62,891	141,761				87,111,315
2040	61,890	19,433	64,847	146,171				89,820,927
2041	63,757	20,019	66,804	150,580				92,530,540
2042	65,624	20,606	68,760	154,990				95,240,152
2043	67,491	21,192	70,716	159,399				97,949,764
2044	69,358	21,778	72,672	163,809				100,659,376

The study forecasts the number of truck at the fourth Thai–Lao Friendship Bridge border checkpoint from year 2015 to 2044 based on the data in year 2012. Linear regression technique is employed for measuring the forecasted data. The forecast can be divided into 3 types of truck including 6 wheels truck, 10 wheels truck, and more than 10 wheels truck. In 2015, total forecasted number of truck is 35,933 then it is increasing year by year until the end of forecast in year 2044 with 163,809 trucks.

2.2 Study the other Thai - Lao Friendship Bridge

Thai- Lao Friendship Bridges are importance from development of the Mekong River region. Moreover, the Friendship Bridges are built to encourage the relationships between Thailand – Lao PDR in terms of economic, social, and cultural. Apart from the fourth Thailand-Lao PDR Friendship Bridge at Chiang-Khong, Thai- Lao have another 3 Friendship Bridges which are The First Thai - Lao Friendship Bridge (Nong Khai - Vientiane), Second Thai–Lao Friendship Bridge (Mukdahan –

Savannakhet), and Third Thai–Lao Friendship Bridge (Nakhon Phanom - Khammouane). Consequently, each Thai-Lao Friendship Bridge has joint to invest with different countries depending on their conditions. Besides that, each bridge has the same purpose but it has different influence on the region.

2.2.1 The First Thai - Lao Friendship Bridge (Nong Khai - Vientiane)

The First Thai- Lao Friendship Bridge across Mekong River is between Nong Khai province in Thailand and Vientiane Prefecture in Lao- PDR. The bridge was built by the cooperation of three countries which are Australia, Lao PDR, and Thailand. The construction took three years from October, 1991 to April, 1994. The length of this bridge is 1,174 meters and wide 12.7 meters. The bridge's layout was designed to have 2 lanes for traveling and the middle of the bridge was designed to support the train. Moreover, there are utilized facilities including the Customs and the Tourism Authority of Thailand (TAT) center that provided tourist information.

Figure 2-4: The First Thai-Lao Friendship bridge

Source: http://en.aectourismthai.com/content1/1168

Table 2-10: Total trade volume of import-export through Nong Khai customs in budget year 2008 to 2014

Budget year	Trade Value (million baht)		Total value (Million Baht)
	Import	Export	
2008	1,851.773	28,623.868	30,475.641
2009	2,032.385	29,282.551	31,314.936
2010	2,849.899	35,270.136	38,120.035
2011	2,582.021	41,470.071	44,052.092
2012	3,428.287	59,547.037	62,975.324
2013	3,391.350	55,871.400	59,262.750
2014	3,328.163	58,266.157	61,548.217

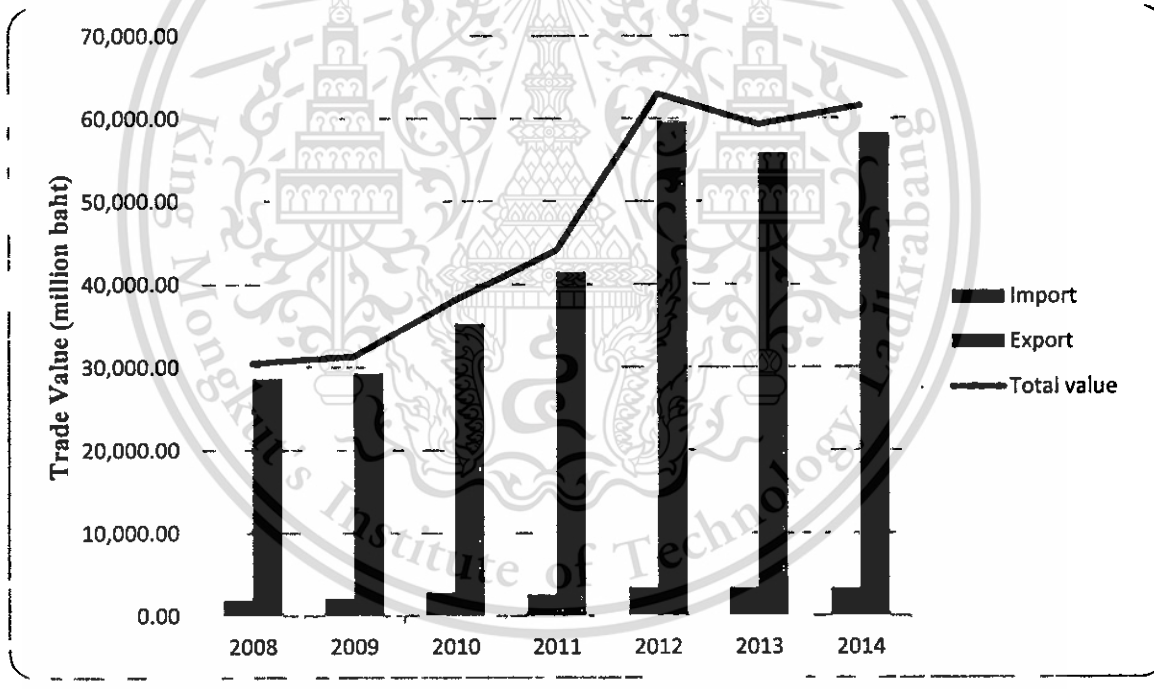

Figure 2-5: Volume of import-export and total value from Nong Khai customs in budget year 2008 to 2014

Statistical data of import and export trade volume from Nong Khai customs is shown in the table 2-10. It shows that the trades volumes from import and export which are clearly imbalanced by the volume of export are more than the imports volume a lot. These results represent the consequence of Nong Khai Bridge which is the gateway to Laos and connected through Vietnam. Thus, it can be used as an important path to export goods through many destinations by the sea port. Moreover, the trade volume from year 2008 to 2014 tend to increase every year especially export volume.

Table 2-11: Numbers of vehicles arrival-departure at Nong Khai customs between budget year 2008 to 2015

Budget Year	Trucks		Empty Trucks		Bus		Private car	
	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart
2008	14,745	50,371	45,951	7,877	3,826	3,826	103,952	105,048
2009	22,068	64,856	47,414	7,889	3,900	3,900	161,515	162,563
2010	24,639	78,600	59,616	5,591	3,975	3,975	280,907	285,103
2011	21,958	80,984	61,257	5,263	3,900	3,900	332,544	334,694
2012	20,716	99,969	77,369	4,461	3,900	3,900	369,756	368,499
2013	18,444	113,492	70,748	4,805	3,900	3,900	398,739	397,363
2014	17,534	94,311	76,569	4,047	3,900	3,900	440,518	439,329
2015 (Jan 14-Feb 15)	7,504	45,067	34,130	1,392	1,650	1,650	203,943	204,140

Note: 1. Truck = Truck + Truck cross border

2. Bus = Bus + Shuttle bus + Van

3. Private car = Passenger cars + Pickups + Ambassador car

Table 2-12: number of travelers arrival-departure at Nong Khai customs between budget year 2008 to 2015

Budget Year	Number of Travelers	
	Arrival	Departure
2008	2,413,947	2,323,108
2009	2,326,370	2,317,481
2010	2,393,898	2,434,321
2011	2,713,495	2,657,100
2012	2,677,706	2,653,223
2013	2,427,016	2,359,971
2014	2,641,453	2,514,520
2015 (Jan 14-Feb 15)	1,190,636	1,141,206

In table 2-11 and table 2-12, the data shows the number of vehicles (truck, bus, and private car) and the number of travelers passing through Nong Khai customs from year 2008-2014. The number of arrivals and departures of each vehicle types are increasing in every year except bus which is quite constant number because the number of registered buses that serves on the bridge is limited. The private cars have higher number than other vehicle types with total number of 209,000 cars in year 2008 up to 879,947 cars in year 2014. The high proportion of export volume in table 2-11 supports the reason that the number of departing trucks is more than arrivals. Because of the traveler behavior at the border, they have to return to their countries, the number of travelers for the arrivals and departure have the same level.

- Review Service Performance of the First Thai - Lao Friendship Bridge (Nong Khai - Vientiane)

The First Thai - Lao Friendship Bridge has been operated for more than 20 years. The volume of traffic on the bridge is increasing and the flow of traffic on the bridge is reducing. This research reviews the service performance of the bridge and finds the appropriate solution to apply on the bridge.

The v/c ratio was used to evaluate the level of service of the bridge. Aimsum program was employed to simulate the traffic flow among the First Thai - Lao Friendship Bridge. Additionally, this ratio derives the standards from the Highway Capacity Manual. This is shown in the table 2-12 below.

Table 2-13: Highway capacity manual

Level of Services, LOS	V/C Ratio	Description
F	> 1.00	Strongly delay
E	0.91 – 1.00	Dramatically delay
D	0.81 – 0.90	Quite delay
C	0.71 – 0.80	Normally delay
B	0.61 – 0.70	Slightly delay
A	<= 0.60	No delay

Table 2-14: The forecasted of service level for the First Thai - Lao Friendship Bridge

Data	Arrival	Departure
20[illegible]		
V/C ratio	1.05	0.29
Rank	F	A
Growth in next Five years		
Vehicle	23%	25%
Tourist Rate	1.4%	
Freight Rate	23.8%	
20[illegible]		
V/C ratio	2.91	0.90
Rank	F	E

Table 2-14 shows the service performance of The First Thai - Lao Friendship Bridge. In year 2014 the performance level of departures is in rank "A" which means it is low significantly delay on the cross border. Then in the arrivals, it is in rank "F", which is there is a lot of delay occurred on this side. However, the researchers suggest that the arrival and departure rate of vehicle in next five years will be

increased by 23% and 25% respectively. Furthermore, the increased rate of tourists and freights are 1.4% and 23.8% respectively. Thus, in next five years the service performance of this bridge will have very low performance. The arrivals rate of vehicles will remain in rank F with an increasing of v/c ratio from 1.05 to 2.91. While, the departures rank will drop from rank A to E (0.29 to 0.90).

- Department of Highways (DOH) 2012: The study of development border checkpoint and truck fleet performance.

Another study is the forecasted total number of truck from DOH, the forecasts conducted the data from year 2012 and determined truck volume from year 2015 to 2044. The purpose of this study is to determine the amount of fees collected at the first Thai–Lao Friendship Bridge border checkpoint. In order to analyze the economic benefit for establishing the weigh station.

Table 2-15: Expected fees at the first Thai–Lao Friendship Bridge border checkpoint (Nong Khai - Vientiane)

Year	Forecasting truck volume per year				Fees (Baht / year)			Total collected fees (Baht / year)
					Freight truck			
	6 wheels	10 wheels	More than 10 wheels	Total	6 wheels	10 wheels	More than 10 wheels	
2015	20,485	28,501	129,146	178,133	250	350	500	79,669,984
2016	22,069	30,705	139,133	191,907				85,830,399
2017	23,715	32,994	149,506	206,215				92,229,799
2018	25,360	35,284	159,880	220,524				98,629,200
2019	27,006	37,573	170,253	234,832				105,028,600
2020	28,651	39,862	180,627	249,140				111,428,001
2021	30,297	42,152	191,000	263,449				117,827,401
2022	31,942	44,441	201,374	277,757				124,226,801
2023	33,588	46,730	211,747	292,065				130,626,202
2024	35,233	49,020	222,121	306,374				137,025,602
2025	36,878	51,309	232,494	320,682	320	450	640	183,686,621
2026	38,524	53,598	242,868	334,990				191,882,432
2027	40,169	55,888	253,241	349,299				200,078,244
2028	41,815	58,177	263,615	363,607				208,274,055
2029	43,460	60,466	273,989	377,915				216,469,866
2030	45,106	62,756	284,362	392,224				224,665,677
2031	46,751	65,045	294,736	406,532				232,861,488
2032	48,397	67,334	305,109	420,840				241,057,299
2033	50,042	69,624	315,483	435,149				249,253,110
2034	51,688	71,913	325,856	449,457				257,448,921

Table 2-15: Expected fees at the first Thai–Lao Friendship Bridge border checkpoint (Nong Khai - Vientiane) (Cont)

Year	Forecasting truck volume per year				Fees (Baht / year)			Total collected fees (Baht / year)
					Freight truck			
	6 wheels	10 wheels	More than 10 wheels	Total	6 wheels	10 wheels	More than 10 wheels	
2035	53,333	74,202	336,230	463,765	410	580	820	340,612,385
2036	54,978	76,492	346,603	478,074				351,121,137
2037	56,624	78,781	356,977	492,382				361,629,890
2038	58,269	81,070	367,350	506,690				372,138,642
2039	59,915	83,360	377,724	520,999				382,647,395
2040	61,560	85,649	388,097	535,307				393,156,148
2041	63,206	87,938	398,471	549,615				403,664,900
2042	64,851	90,228	408,845	563,924				414,173,653
2043	66,497	92,517	419,218	578,232				424,682,405
2044	68,142	94,806	429,592	592,540				435,191,158

According to table 2-15, total number of trucks forecasted in year 2015 is equal to 178,133 including 6 wheels, 10 wheels, and more than 10 wheels truck and it can create the value of 79,669,984 baht.

2.2.2 The Second Thai–Lao Friendship Bridge (Mukdahan – Savannakhet)

The Second Thai–Lao Friendship Bridge is located in Mukdahan province; it connects the northeastern of Thailand with Savannakhet province in Lao PDR. It was officially opened on 20th December 2006. This bridge facilitates the travel of people and freight between Thailand and Lao PDR. The bridge has length 1,524 meters in Thailand and 1,718 meters in Lao PDR. For these reason, trade, investment, and tourism between Thailand and Laos are more improved. Moreover, the second Friendship Bridge strongly supports the economy of East-West Economic Corridor (route 9) between Laos, Thailand, and Vietnam.

Figure 2-6: The Second Thai–Lao Friendship Bridge

Source: http://jobbydee.blogspot.com/2012/12/2.html

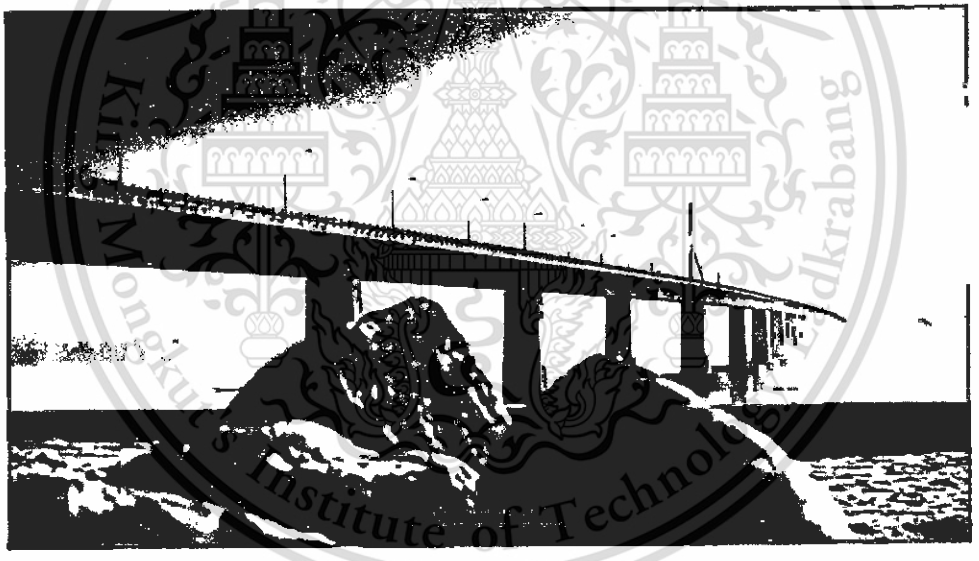

Figure 2-7: The Second Thai–Lao Friendship Bridge

Source: https://www.facebook.com/pinto.photofanpage

Table 2-16: Total trade volume of import-export through Mukdahan Customs from budget year 2008 to 2015

Budget Year	Trade Value (million baht)		Total Value (Million Baht)	Trade Balance (Million Baht)
	Import	Export		
2008	15,040.86	9,490.10	24,530.96	-5,550.77
2009	9,015.28	8,343.43	17,358.72	-671.85
2010	13,582.64	23,077.65	36,660.29	9,495.00
2011	23,695.13	44,412.86	68,107.99	20,717.73
2012	32,059.75	57,796.33	89,856.08	25,736.58
2013	25,430.16	41,874.59	67,304.75	16,444.43
2014	29,328.14	36,426.98	65,755.12	7,098.84
2015 (Oct 14- Feb 15)	13,999.42	10,671.22	24,670.64	-3,328.20

From table 2-16, the import and export volume at Mukdahan is slightly fluctuated. The trade balances from the first two years in this table have a negative value which is called a trade deficit. After year 2009, the trade volume are increased continuously until 2012 and decreased in year 2013. The border trade situation at Mukdahan is decreased because of the increasing of the freight route crossing the border such as in Nakhon Phanom customs and Ubon Ratchathani Customs. From this reason the operators have many alternatives (shipping fast, convenient, and the cheapest cost) to shift the product to the destination.

Table 2-17: Numbers of vehicles arrival-departure at Mukdahan customs between budget year 2008 to 2015

Budget Year	Trucks		Empty Trucks		Bus		Private car	
	Arrival	Departure	Arrival	Departure	Arrival	Departure	Arrival	Departure
2008	5,221	18,747	15,994	2,504	5,728	5,868	47,474	48,447
2009	5,255	23,767	21,309	2,850	5,573	5,370	79,868	81,730
2010	7,606	22,581	19,500	4,552	5,716	5,581	103,523	105,029
2011	9,098	22,988	19,367	5,849	5,452	5,451	107,763	117,578
2012	10,599	31,092	24,867	6,147	5,319	5,474	107,180	130,297
2013	12,699	32,137	25,040	6,002	5,321	5,509	83,163	108,807
2014	14,377	30,324	23,735	7,520	4,972	4,982	103,544	113,989
2015 (Jan 14-Feb 15)	6,149	13,754	9,846	2,033	2,039	1,972	61,253	62,539

The numbers of vehicles arrival-departure at Mukdahan customs between budget year 2008 to 2015 in table 2-17 can be classified into 4 types which are truck, empty truck, bus and private car. When comparing truck and empty truck, the departure of trucks are twice numbers of arrivals, but the departures of empty trucks is less than a half of arrivals numbers. In another types, the numbers of arrivals and departures of bus are not much different because most of the travelers have the form as return trip. For the last type, the numbers of private cars from year 2008 to 2015 tended to increase continuously.

Table 2-18: Numbers of arrival-departure travelers at Mukdahan customs between budget years 2008 to 2015

Budget Year	Numbers of Travelers	
	Arrival	Departure
2008	434,016	430,235
2009	603,048	551,092
2010	881,852	849,893
2011	1,130,964	1,099,094
2012	1,137,666	1,166,296
2013	832,724	862,848
2014	745,427	756,730
2015 (Jan 14-Feb 15)	344,547	335,061

From table 2-18, numbers of travelers at Mukdahan customs between budget years 2008 to 2015 have been increased steadily. From year 2011 to 2012, the numbers of both arrival and departure are higher than other year. However, the numbers of arrival and departure from year 2013 till the present are slightly dropped.

- Department of Highways (DOH) 2012: The study of development border checkpoint and truck fleet performance.

According to the study, DOH determined the proportion of truck based on the number of traffic through the bridge in past 5 years. Table 2-19 presents the expected fees at the second Thai–Lao Friendship Bridge border checkpoint.

Table 2-19: Expected fees at the second Thai–Lao Friendship Bridge border checkpoint (Mukdahan – Savannakhet)

Year	Forecasting truck volume per year				Fees (Baht / year)			Total collected fees (Baht / year)
					Freight truck			
	6 wheels	10 wheels	More than 10 wheels	Total	6 wheels	10 wheels	More than 10 wheels	
2015	15,094	5,427	25,081	45,603	250	350	500	18,213,639
2016	16,115	5,794	26,777	48,686				19,445,039
2017	17,135	6,160	28,473	51,769				20,676,439
2018	18,156	6,527	30,169	54,852				21,907,839
2019	19,176	6,894	31,864	57,935				23,139,239
2020	20,197	7,261	33,560	61,018				24,370,639
2021	21,218	7,628	35,256	64,101				25,602,039
2022	22,238	7,995	36,951	67,184				26,833,439
2023	23,259	8,362	38,647	70,268				28,064,840
2024	24,279	8,729	40,343	73,351				29,296,240
2025	25,300	9,096	42,039	76,434	320	450	640	39,093,570
2026	26,320	9,463	43,734	79,517				40,670,496
2027	27,341	9,829	45,430	82,600				42,247,422
2028	28,361	10,196	47,126	85,683				43,824,348
2029	29,382	10,563	48,821	88,766				45,401,274
2030	30,402	10,930	50,517	91,849				46,978,200
2031	31,423	11,297	52,213	94,933				48,555,126
2032	32,443	11,664	53,909	98,016				50,132,052
2033	33,464	12,031	55,604	101,099				51,708,978
2034	34,484	12,398	57,300	104,182				53,285,904

Table 2-19: Expected fees at the second Thai–Lao Friendship Bridge border checkpoint (Mukdahan – Savannakhet) (Cont)

Year	Forecasting truck volume per year				Fees (Baht / year)			Total collected fees (Baht / year)
					Freight truck			
	6 wheels	10 wheels	More than 10 wheels	Total	6 wheels	10 wheels	More than 10 wheels	
2035	35,505	12,765	58,996	107,265	410	580	820	70,336,878
2036	36,525	13,131	60,691	110,348				72,358,576
2037	37,546	13,498	62,387	113,431				74,380,274
2038	38,566	13,865	64,083	116,514				76,401,971
2039	39,587	14,232	65,779	119,598				78,423,669
2040	40,607	14,599	67,474	122,681				80,445,366
2041	41,628	14,966	69,170	125,764				82,467,064
2042	42,648	15,333	70,866	128,847				84,488,761
2043	43,669	15,700	72,562	131,930				86,510,459
2044	44,689	16,067	74,257	135,013				88,532,156

2.2.3 The Third Thai–Lao Friendship Bridge (Nakhon Phanom- Khammouane)

The Third Thai–Lao Friendship Bridge is the linkage between Nakhon Phanom province in Thailand and Khammoune in Laos. This bridge is an importance transportation route for trading and traveling which are connected to Thailand, Lao PDR, Vietnam, and south of China. Furthermore, a total length of the bridge is 780 meters with a width of 13 meters, 2-lanes and without railways. This Friendship Bridge is an importance economic route of north- eastern economic corridor. Moreover, it can facilitate the travel in Nakhon Phanom because the tourists can cross to a neighboring country comfortably.

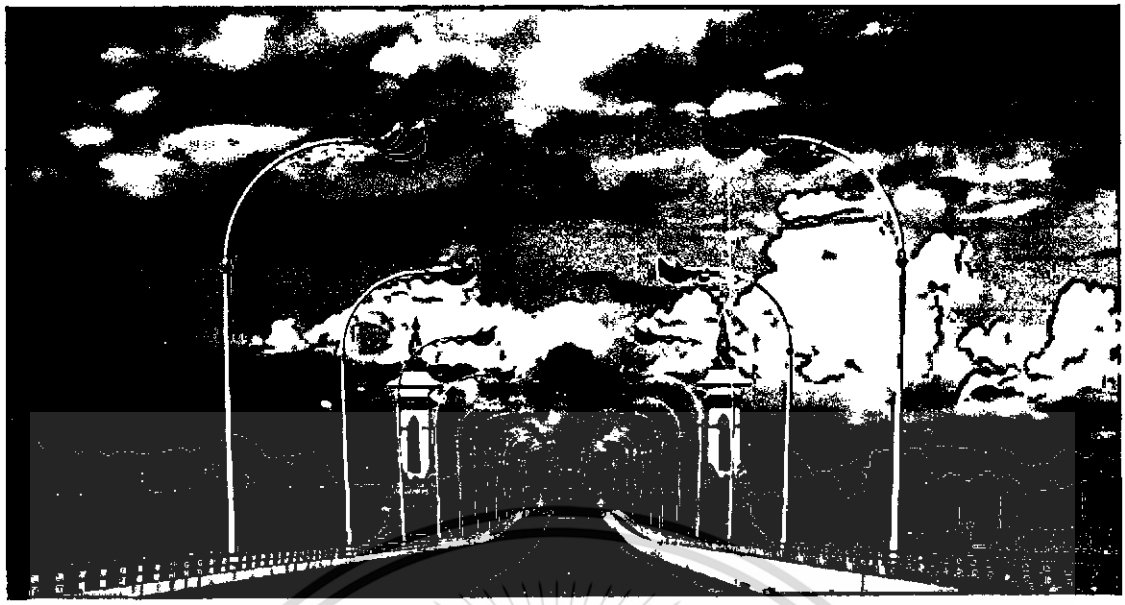

Figure 2-8: The Third Thai-Lao Friendship Bridge

Source: http://nakhonphanomtravel.blogspot.com/2008/01/bussiness-information-thailandwith.html

2.2.3.1 Department of Land Transport (DLT) 2013: Nakornphanom Logistics Facility

Statistical data of the value of imports - exports through customs of Nakhon Phanom in last 11 years (years 2003-2013) had founded a surplus of exports over imports and it tended to increase continuously. After the official operation of the Third Thai–Lao Friendship Bridge in November 2011, it affected to the expanding of border trade volume in Nakhon Phanom. At this point, the total trade value in year 2012 and 2013 was increased from year 2011 by more than 1.6 times and 7 times, respectively. This is the result of the opening of the third Friendship Bridge. The information is shown in table 2-20 and figure 2-9 below.

Table 2-20: Total trade volume of import-export through Nakhon Phanom border from year 2003-2013

Year	Trade Value (million baht)		Trade Balance (Million Baht)
	Import	Export	
2003	523.5	1,385.6	+862.1
2004	871.2	1,088.8	+217.6
2005	635.6	2,419.0	+1,783.4
2006	505.4	3,766.9	+3,261.5
2007	753.7	3,697.4	+2,943.7
2008	1,270.4	4,105.1	+2,834.7
2009	1,508.4	3,647.5	+2,139.1
2010	1,547.8	4,136.6	+2,588.8
2011	2,429.7	4,602.8	+2,173.1
2012	3,201.6	8,307.7	+5,106.1
2013	12,214.60	38,260.90	+26,046.30

Source: Bank of Thailand 2013

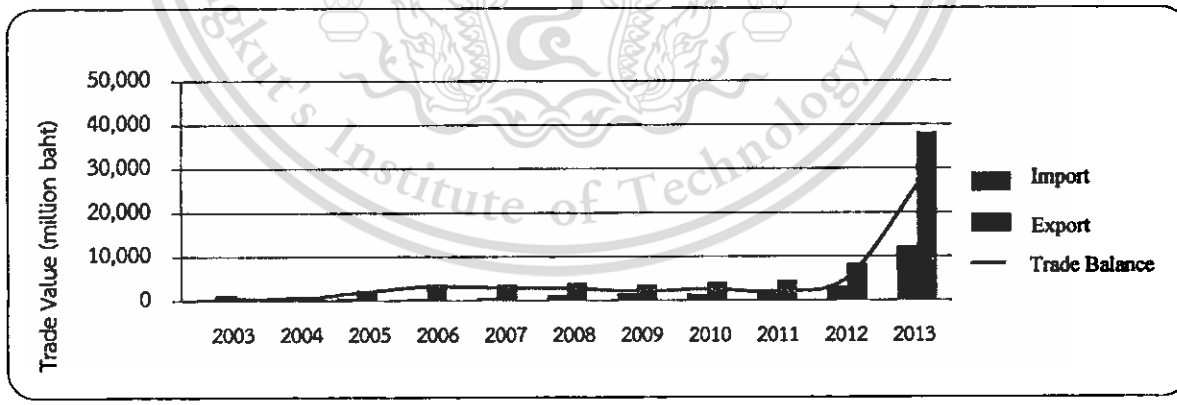

Figure 2-9: Volume of import-export and trade balance through Nakhon Phanom border from year 2003-2013

Source: Bank of Thailand 2014

Table 2-21: Forecasting trend of import goods through the border Nakhon Phanom (million baht).

Year	Actual data during the year 2007-2012	Case 1: does not consider the effect of AEC	Case 2: consider the effect of AEC
2007	32		
2008	158		
2009	590		
2010	868		
2011	1,406		
2012	1,495		
2013		1,819	
2014		2,143	
2015		2,467	
2016		2,791	2,858
2017		3,115	3,266
2018		3,439	3,694
2019		3,763	4,142
2020		4,087	4,611
2021		4,411	5,101
2022		4,735	5,613
2027		6,355	8,542
2032		7,974	12,176
2037		9,595	16,658

According to the forecasts, import trends through the border of Nakhon Phanom in table 2-21. The first case did not consider the effect of ASEAN Economic Community (AEC), in year 2027, the number of product imported has a value of 6,355 million baht. While in case of considering the effect of AEC, the volume of import in year 2027 will be up to 8,542 million baht or higher than normal growth of economic about 34.4 percent. However, it depends on the capabilities of the integration of ASEAN member countries.

Table 2-22: Forecasts trend of export goods through the border Nakhon Phanom (million baht).

Year	Actual data	Case 1: does not consider the effect of AEC	Case 2: consider the effect of AEC
2007	2,473		
2008	2,509		
2009	2,326		
2010	2,818		
2011	2,481		
2012	4,290		
2013		4,400	
2014		4,570	
2015		4,841	
2016		5,113	5,251
2017		5,384	5,566
2018		5,655	5,900
2019		5,926	6,254
2020		6,198	6,629
2021		6,469	7,027

Table 2-22: Forecasts trend of export goods through the border Nakhon Phanom (million baht) (Cont)

Year	Actual data	Case 1: does not consider the effect of AEC	Case 2: consider the effect of AEC
2022		6,740	7,448
2027		8,096	9,967
2032		9,453	13,338
2037		10,871	17,873

Nakhon Phanom has a permanent border checkpoint in both downtown area and at the Third Thai–Lao Friendship Bridge. Nowadays, permanent cross border in Nakhon Phanom allows only people who want to travel across borders from Thailand to Lao PDR only. Thus, the people who need to travel through the third country such as China, Vietnam and Thailand have to checkpoint at the bridge.

Table 2-23: The forecasted number of people and vehicles traveling in – out the Third Thai–Lao Friendship Bridge

Year	Number of people crossing the bridge (Person / day)	Group 1: private car		Group 2: vans		Group 3: bus	
		Travelers (Person / day)	Vehicles [1] (Vehicles / day)	Travelers (Person / day)	Vehicles [1] (Vehicles / day)	Travelers (Person / day)	Vehicles [1] (Vehicles / day)
2017	3,984	1,686	843	919	92	1,379	46
2022	7,398	3,130	1,565	1,707	171	2,561	85
2027	10,842	4,587	2,294	2,502	250	3,753	125
2032	14,367	6,078	3,039	3,315	332	4,973	166
2037	17,973	7,604	3,802	4,148	415	6,221	207

Note: [1] The Occupancy Rate is equal to 2 people per private car, 10 people per van, and 30 people per bus.

According to the forecasted data in year 2027, the Third Thai–Lao Friendship Bridge will support the number of people traveling in – out approximately 10,842 people per day. Wherewith, the group traveling by private car will be about 4,587 people per day or 2,294 vehicles per day. The groups traveling by van are about 2,502 people per day or 250 vehicles per day. And the groups who are traveled by bus are about 3,753 person per day or 125 vehicles per day.

Table 2-24: The forecasted number of people traveling in – out across The Third Thai–Lao Friendship Bridge per year

Year	Passport / Border passes Thailand - Laos	Other national passports	Total
2011	194,050	127,800	321,850
2012	257,395	199,789	457,184
2013	359,115	278,745	637,860
2014	525,200	407,660	932,860
2015	691,285	536,575	1,227,860
2016	857,370	665,490	1,522,860
2017	1,023,455	794,405	1,817,860
2022	1,788,023	1,504,837	3,292,860
2027	2,479,287	2,288,573	4,767,860
2032	3,246,287	2,996,573	6,242,860
2037	4,013,287	3,704,573	7,717,860

Source: Immigration Office of Nakhon Phanom year 2011-2013 (April).

In table 2-24 represents the forecasted number of people traveling in – out border of Nakhon Phanom province. Base on this information, it can be concluded that the number of people tends to be increased continuously to 1.8 million people in year 2017. Moreover, it will rise up to 4.7 million people in year 2027.

Table 2-25: Summarize the methodologies of literature reviews

Studied	Forecasts	Methodology	Forecast period
The First Thai - Lao Friendship Bridge (Nong Khai - Vientiane)			
Review Service Performances of the First Thai - Lao Friendship Bridge (Nong Khai - Vientiane)	Number of Vehicle	Aimsum program	2014-2019 (6 Years)
	Number of tourists		
	Number of freight		
Department of Highways (DOH) 2012	- Number of Vehicle and fee	Linear regression	2015-2044 (29 Years)
The Second Thai-Lao Friendship Bridge (Mukdahan – Savannakhet)			
- Department of Highways (DOH) 2012	- Number of Vehicle and fee	-. Linear regression	2015-2044 (29 Years)
The Third Thai-Lao Friendship Bridge (Nakhon Phanom – Khammouane)			
Department of Land Transport (DLT) 2013	Value of import	Time series analysis based on 2007 to 2012	2007-2037 (30 Years)
	Value of export		2007-2037 (30 Years)
	Number of travelers and vehicles	Not given	2017-2037 (20 Years)
	Number of people	Not given	2011-2037 (27 Years)

Note: Some studies did not provide method of analysis.

Table 2-25: Summarize the methodologies of literature reviews (Cont)

Studies	Forecasts	Methodology	Forecast period
The Fourth Thai-Lao Friendship Bridge (Chiang-Khong – Houayxay)			
Port Authority of Thailand (PAT)	Trade volume	Econometric Model with Microscopic Qualitative Analysis	2014-2019 (5 Years)
Office of Transport and Traffic Policy and Planning (OTP)	Freight Volume	Not given	2014-2041 (27 Years)
	Import and Export Volumes	Not given	2014-2041 (27 Years)
Department of Highways (DOH) 2009	Traffic volume	Capacity Restraint	2009-2034 (25 Years)
Department of Highways (DOH) 2012	- Number of Vehicle and fee	Linear regression	2015-2044 (29 Years)

Note: Some studies did not provide method of analysis.

Chapter 3

METHODOLOGY

3.1 Study Methodology

According to researches related to trade and transportation around the Thai – Lao Friendship Bridge. Many researches are on future trade value, traffic flow, and travelers around the bridge to suggest the development plans and policies to improve performance and facilitate the trade between countries. However, forecasting methods were differently employed for each research for generating future demand for transportation and trade. Thus, this research is aimed to review different forecasting methods in order to identify the most appropriate technique for studying demand of traffic among the bridge and trade values. Descriptive analysis was employed for measuring the differential percentage between actual data and forecast data among studies of the Friendship Bridge.

3.1.1 Study Framework

This research is aimed to cover in many perspectives of development of the 4th Friendship Bridge. Two analyses were employed. First analysis was related to direct and indirect comparative techniques. It was employed for measuring the different percentage of actual data and forecasting data from previous researches. The result represents accuracy of the forecasting methods in different researches. In order to evaluate the characteristic of trade at the border checkpoint of each Friendship Bridge, trend analysis and descriptive statistics in second analysis were used. Results from those methods enabled identification of characteristics and trading situation of cross border. After that, results from both analysis technique are used to conduct overall analysis of Chiang-Khong cross border. The factors influencing the border trade of Chiang-Khong are concerned to create appropriate

plan to improve trade situation at Chiang-Khong. In consequence, the suggestions are developed based on every perception of the 4th Friendship Bridge.

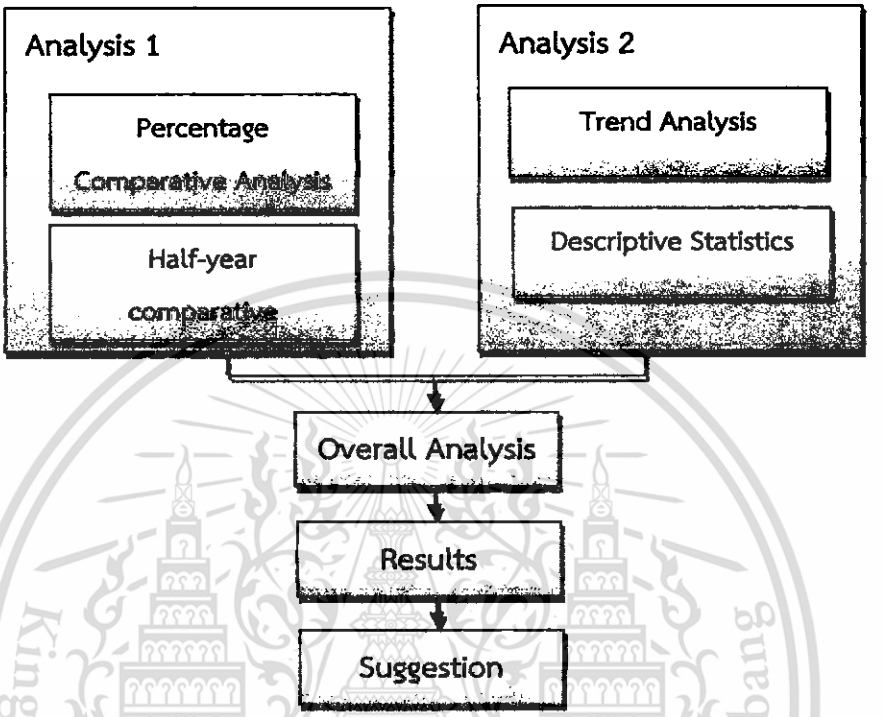

Figure 3-1: Research Framework

3.1.2 Analysis Techniques

Analysis techniques are general techniques for studying differences of two or more data sets with similar situation. Comparison is made to identify percentage difference of the results of previous studies to clarify the accuracy of the previous study. However, forecasting techniques were conducted differently in different year and researches methodologies are varied. Due to the different growth rate in each study, the comparative method in this research can be divided into direct comparison and indirect comparison.

- Analysis 1: Percentage comparative analysis and half-year comparative analysis

The purpose of percentage comparative analysis is to pinpoint the accuracy of the forecast from previous researches. In order to determine an appropriate measurement of the studies of the Friendship Bridges and transportation along Mekong River, information from related researches on the Friendship Bridges is reviewed and compared. Although the forecast data in each study is different in term of forecast year and data, the percentage increase in each study is compared to each other as well as compared with actual data for measuring the accuracy.

Unfortunately, in 2015 the forecast predicted the value for one year but the actual data are available only for half-year. In order to compare the actual data with the forecasted data, the actual value in 2015 was estimated for the remaining half of the year. The actual data from the previous years were evaluated to measure the weight percentage of the data divided into first half and second half of the year. Then the actual data in 2015 was multiplied by the weight of the second half of the previous year.

The results from this analysis are presented in the percentage increase in each study with different data type including; import and export values, number of travelers and vehicles. Then, an accuracy of each research was identified to determine appropriate technique for studying trade and transportation among Mekong River.

- Analysis 2: Trends Analysis and Descriptive Statistics

Historical data is significant information for analyzing the performance of the operation. The data from all Friendship Bridges were analyzed to identify transportation trend of cross border across Mekong River. Growth rate represents importance of each bridge and transportation route may shift from one bridge to another when it was being operated. Moreover, growth rate can clarify the overall transportation trends within the region. There are two important results in the analysis of historical data including transportation trends and initial state comparison

of each bridge. In order to determine trend of the transportation across Mekong River, historical data of trade at each border checkpoint including the First Friendship Bridge (Nong Khai), the Second Friendship Bridge (Mukdahan), the Third Friendship Bridge (Nakhon Phanom), and the Fourth Friendship Bridge (Chiang-Khong) were analyzed to measure similarity and difference in trends of those four important border checkpoints between Thailand and Lao PDR. The statistical data of the bridges were plotted as a graph for measuring an annual increase rate of trade around each Friendship Bridge. Moreover, the proportion of transportation on four bridges was explored. Finally, the trends before and after an official open of the bridges were used to analyze transportation trends in both import and export directions. Construction of a bridge usually affects the overall transportation within a region. Thus, growth rate of each bridge, when it was firstly operated, were compared to measure the increase of trend in each area. Moreover, it represents change in transportation routes among the region.

Descriptive Statistics was conducted to explain the information of the trade and transportation among the bridge. It is one of the statistical methods known as an important technique for explaining information. Results are usually shown in form of table, figure, graph, percentage, and etc. In addition, the information can be classified into 2 forms; first is the quantitative variable such as age and weight. Another is the qualitative variables such as the abilities of employees, and the satisfaction of workers. In this study, descriptive statistics was used to explain the transportation and trade value among the Friendship Bridges. The historical data of trade over past 10 years of each Thai-Lao Friendship Bridge was used to make a comparison. The result of comparing trade value is represented in graph. Then, it is possible to identify the transportation trends.

3.2 Data and Information Used in the Study

According to the previous section, data and information reviewed in this study can be divided into two parts; first, data from the previous studies related to Thai-Lao Friendship Bridges. These researches are conducted by governmental institutes which are responsible for development of economy and transportation activities around Thai-Lao Friendship Bridges including; Port Authority of Thailand (PAT), Office of Transport and Traffic Policy and Planning (OTP), and Department of Highways (DOH). Second part is descriptive data for supporting the data in the first part and other external data related to the Thai-Lao Friendship Bridge. This supporting data led to better explanation of situations that occurred and were studied in the past.

Chapter 4

Analysis and Results

4.1 Comparison of Forecasted Results from Previous Studies and Revealed Statistics of the Fourth Thai-Lao Friendship Bridge

According to previous studies, many governmental institutes have responsibility to develop infrastructures for supporting national trade and transportation across border. They have studied on the factor that may influence cross border in the future. Trade value and vehicle were mostly concerned for conducting the research among Friendship Bridges. Trade volume is seen as the main factor to represent national economic growth and number of vehicle is frequently concerned for measuring the transportation trends at the Friendship Bridge.

It is founded that the study from Port Authority of Thailand or PAT (Study 1) had evaluated the causes and effects of Chiang-Khong port and Chiang-Sean port after the Fourth Thai-Lao Friendship Bridge was opened. Moreover, PAT's study forecasted trade volume at border of Chiang-Khong from year 2014 to 2019. The forecast is used to classify the percentage increase.

The Study of the Detailed Design and Operation and Management of Intermodal Facilities at Chiang-Saen – Chiang-Khong, Chiang Rai Province from Office of Transport and Traffic Policy and Planning (OTP) (study 2) was employed to forecast the freight volume of goods through the Intermodal Facilities at Chiang-Kong via the container (TEU).

Study 3 is a report from Department of Highways (DOH) in 2009; the topic is The Economic, Engineering and Environmental Impacts of The Construction 4-lane Highway Network - Bridge over the Mekong River at Chiang-Khong. They focused on the traffic at the border checkpoint of Chiang-Khong, the results were presented as number of travelers and weight of goods transported across the bridge.

The last study, number of vehicle was mostly concerned in the project of Development Border Checkpoint and Truck fleet Performance in 2012 from the Department of Highways (DOH) for predicting border fees across the 4th Friendship Bridge. In addition, the actual data of vehicle volume in year 2015 are available only first half budget year. Thus this research used data from the last 3 year to measure the average proportions of the first half and the second half year as reference for the predict the percentage growth of present year.

Table 4-1: Comparison actual data and forecast data of Chiang-Khong studies

Year	Actual Trade Value			Study 1						Actual		Study 2	Study 3		Study 4
				Forecast: Case of growth based on GDP			Forecast: Case of growth rapidly			Truck	Vehicle	Forecast: Truck	Forecast: Weight (ton)	Forecast: travelers	Forecast: Vehicle
	Import	Export	Total	Import	Export	Total	Import	Export	Total	Total	Total	Total	Total	Total	Total
2009	-	-	-	-	-	-	-	-	-	87.78%	80.49%	-	Based year		-
2010	75.53%	66.07%	69.27%	-	-	-	-	-	-	83.93%	79.84%	-	4%	5.53%	-
2011	31.02%	84.95%	66.04%	-	-	-	-	-	-	56.03%	55.58%	-	4%	5.53%	-
2012	35.39%	59.39%	52.75%	-	-	-	-	-	-	30.14%	28.66%	-	4%	5.53%	-
2013	8.89%	8.94%	8.93%	-	-	-	-	-	-	12.26%	17.61%	-	4%	5.53%	-
2014	-1.74%	16.44%	11.99%	-	-	-	-	-	-	2.94%	40.99%	-	4%	5.53%	-
2015	2.40%	-7.56%	-5.42%	11.48%	12.85%	12.52%	15.14%	16.69%	16.31%	14.75%	47.98%	-	4%	5.53%	-
2016	-	-	-	11.50%	12.85%	12.53%	15.16%	16.68%	16.31%	-	-	-	3.35%	5.24%	12.27%
2017	-	-	-	11.52%	12.85%	12.53%	15.14%	16.69%	16.32%	-	-	-	3.35%	5.24%	10.93%
2018	-	-	-	11.49%	12.85%	12.53%	15.14%	16.69%	16.32%	-	-	411.04%	3.35%	5.24%	9.85%
2019	-	-	-	11.50%	12.85%	12.53%	15.14%	16.68%	16.33%	-	-	-	3.35%	5.24%	8.97%

Table 4-1: Comparison actual data and forecast data of Chiang-Khong studies (Cont.)

Year	Actual Trade Value			Study 1						Actual		Study 2	Study 3		Study 4
				Forecast: Case of growth based on GDP			Forecast: Case of growth rapidly			Truck	Vehicle	Not specific (Truck)	Forecast: Weight (ton)	Forecast: travelers	Forecast: Vehicle
	Import	Export	Total	Import	Export	Total	Import	Export	Total	Total	Total	Total	Total	Total	Total
2020	-	-	-	-	-	-	-	-	-	-	-	-	3.10%	4.26%	8.23%
2021	-	-	-	-	-	-	-	-	-	-	-	-	3.10%	4.26%	7.60%
2022	-	-	-	-	-	-	-	-	-	-	-	-	3.10%	4.26%	7.07%
2023	-	-	-	-	-	-	-	-	-	-	-	-	3.10%	4.26%	6.60%
2024	-	-	-	-	-	-	-	-	-	-	-	-	3.10%	4.26%	6.19%
2025	-	-	-	-	-	-	-	-	-	-	-	-	3.06%	3.86%	5.83%
2026	-	-	-	-	-	-	-	-	-	-	-	-	3.06%	3.86%	5.51%
2027	-	-	-	-	-	-	-	-	-	-	-	-	3.06%	3.86%	5.22%
2028	-	-	-	-	-	-	-	-	-	-	-	178.65%	3.06%	3.86%	4.96%
2029	-	-	-	-	-	-	-	-	-	-	-	-	3.06%	3.86%	4.73%
2030	-	-	-	-	-	-	-	-	-	-	-	-	2.79%	3.11%	4.52%
2031	-	-	-	-	-	-	-	-	-	-	-	-	2.79%	3.11%	4.32%
2032	-	-	-	-	-	-	-	-	-	-	-	26.25%	2.79%	3.11%	4.14%

Table 4-1: Comparison actual data and forecast data of Chiang-Khong studies (Cont.)

Year	Actual Trade Value			Study 1						Actual		Study 2	Study 3		Study 4
				Forecast: Case of growth based on GDP			Forecast: Case of growth rapidly			Truck	Vehicle	Forecast: Truck	Forecast: Weight (ton)	Forecast: travelers	Forecast: Vehicle
	Import	Export	Total	Import	Export	Total	Import	Export	Total	Total	Total	Total	Total	Total	Total
2033	-	-	-	-	-	-	-	-	-	-	-	-	2.79%	3.11%	3.98%
2034	-	-	-	-	-	-	-	-	-	-	-	-	2.79%	3.11%	3.82%
2035	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.68%
2036	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.55%
2037	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.43%
2038	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.32%
2039	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.21%
2040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.11%
2041	-	-	-	-	-	-	-	-	-	-	-	63.49%	-	-	3.02%
2042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.93%
2043	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.84%
2044	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.77%

According to the table 4-1, the percentage increase of forecasted import and export value in study 1 can be analyzed into 2 cases; first is assuming that the growth of development of infrastructure of Lao PDR is based on GDP. Second is assuming the infrastructures of Lao PDR will grow rapidly. According to the forecasted trade, the percentage increases at Chiang-Khong from year 2014 to 2019 are quite constantly increased in both cases. The percentage growth of import, export, and total value in case 2 are 15 percent, 16.7 percent, and 16.3 percent respectively which are approximately 4 percent higher than case 1. When comparing actual data with case 1 and case 2 at year 2015, the percentage growth of an actual data is enormously different from predictions. As the actual trade value trends show that from year 2013 until now, there is a downward trend and the percentage growth are very far from both cases.

Next, the forecasted data in study 2 was forecasted in long- term period and the prediction will start in year 2018. As for this reason, the forecasted data are far from the actual data. Moreover, the actual data in year 2015 has growth to 14.75%. So, there is very low possibility to rise to 411.04% in year 2018 as forecasted.

In study 3, two factors were forecasted, which were freight weight (ton) and number of traveler. In addition, both factors had been forecasted into four periods by using year 2009 as a base year. For this research, actual data of truck weight is used to compare with the first period of forecasted weight (ton). According to data of percentage growth of actual and forecasted truck weight form year 2010 to 2015, the percentage growth of forecast remains the same at 4 percent but the actual growth rate in 2010 are 20 times of the forecasted as it is 83.93 percent. Although the actual growth rate is in a downward trend, the actual percentage growth in year 2015 is still higher than the forecasted by 14.75 percent. For number of traveler, the first forecasted period was also used to compare with actual data which is 5.53 percent stable growth. As the comparison results, the actual growth rate between year 2011 and 2013 were also much higher than the forecasted growth by 9.58 percent and 18.85 percent respectively.

The last study has only one factor to compare with actual data which is the vehicle factor. Unfortunately, the forecasted data start to forecast from year 2016 to

2044 but actual data are available from year 2009 to 2015. Thus, this study cannot be compared with actual data.

4.2 Comparison of Forecasted Results from Previous Studies and Revealed Statistics of other Thai-Lao Friendship Bridges

The data on the table 4-2 and table 4-3 show percentage growth of actual and forecasted data among the 1st, 2nd, and 3rd Thai-Lao Friendship Bridges. According to the previous studies, each Thai-Lao Friendship Bridge was studied in different factors based on the objective of each governmental institute . Forecasted data on The 1st Thai-Lao Friendship Bridge were brought from two studies. The First is a service performance review of the First Thai - Lao Friendship Bridge conducted by Transportation Research Center of Thammasat University. Second study is a study on development of border checkpoint and truck fleet performance by Department of Highways (DOH). When comparing the first study in year 2014 with actual data, the forecasted percentage growth of total trade value (4.70 percent) is quite close to actual data (4.14 percent). Moreover, the percentage growth of forecasted departing vehicle is also near the actual data (5 percent and 4.24 percent respectively). In contrast, the forecasted percentage growth of travelers and vehicle arrival are far from actual data. Another study on the 1st Friendship Bridge is forecasting amount of vehicles. Unfortunately, the actual data are available only until 2014 but the forecast starts at 2015. For this reason, the forecasted percentage growth cannot be compared.

For the 2nd Thai-Lao Friendship Bridge, There is only one study about the development of border checkpoint and truck fleet performance from the Department of Highways (DOH). This study focuses on number of vehicle. However, actual data are not enough to compare with the forecasted data.

Lastly, there are three studies that predicted the future trends with different factors for the 3rd Thai-Lao Friendship Bridge. First one is a study from Nakhon Phanom Logistics Facility, Department of Land Transport (DLT). This study is focused

on the trade value as it is divided into two cases; Case 1: does not consider effect of AEC and Case 2: consider effect of AEC. When comparing the forecasted import and export value in case 1 with actual data, the percentage growth of actual data is extremely higher than the forecasted data. The actual import and export growth in 2014 are 267.82 percent and 48.66 percent respectively but the forecasted data are 17.81% and 3.86% for import and export respectively. For case 2, actual data cannot bring into comparison with the forecasted data because the forecast starts from year 2016 to 2037. The second study is focused on number of travelers and vehicles. Unfortunately, both forecasted data in these studies predict value in every 5 years starting from 2017 to 2037. Thus, the second study of the 3rd Thai-Lao Friendship Bridge cannot be compared the percentage growth with actual data to determine precision. The last study is focused on travelers and predicts from year 2011 to 2037. This study, the percentage growth from year 2012 and 2013 of both forecast and actual data are almost equal. Yet, percentages in 2014 are far from each other. Forecasted data is 46.25 percent but actual data is only 7.99 percent growth from the previous year by.

Table 4-2: The summary of actual data among the 1st, 2nd, and 3rd Thai-Lao Friendship Bridges

Year	1st Friendship Bridge							2nd Friendship Bridge	3rd Friendship Bridge			
	Actual							Actual	Actual			
	Trade Value			Traveller	Vehicle			Vehicle	Trade Value		Traveller	Vehicle
	Import	Export	Total	Total	Arrival	Departure	Total	Total	Import	Export	Total	Total
2010	40.22%	20.45%	21.73%	4.0%	57.15%	56.04%	56.59%	21.91%	-6.25%	26.52%	3.69%	-
2011	-9.40%	17.58%	15.56%	11.2%	13.69%	13.82%	13.75%	2.84%	36.73%	11.89%	19.88%	49.87%
2012	32.78%	43.59%	42.96%	-0.7%	12.41%	12.24%	12.32%	15.02%	27.51%	22.53%	42.05%	87.86%
2013	0.13%	-6.53%	-6.16%	-10.2%	4.26%	8.96%	6.62%	-9.35%	238.35%	418.28%	34.04%	21.68%
2014	-3.05%	4.68%	4.15%	7.7%	9.49%	4.24%	6.79%	10.14%	267.82%	48.66%	7.99%	41.50%

Table 4-3: The summary of forecasting data among the 1st, 2nd, and 3rd Thai-Lao Friendship Bridges studies

Year	1st Friendship Bridge					2nd Friendship Bridge	3rd Friendship Bridge						
	Study 1				Study 2	Study 1	Study 1				Study 2		Study 3
	Trade value	Travelers	Vehicle		Vehicle	Vehicle	Case 1		Case 2		Travelers	Vehicle	Travelers
	Total	Total	Arrive	Depart	Total	Total	Import	Export	Import	Export	Total	Total	Total
2010	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	-	-	-	-	-	-	-	-	-	-	-	-	42.05%
2013	-	-	-	-	-	-	-	-	-	-	-	-	39.52%
2014	4.70%	0.28%	4.60%	5.00%	-	-	17.81%	3.86%	-	-	-	-	46.25%
2015	4.70%	0.28%	4.60%	5.00%	-	-	15.12%	5.93%	-	-	-	-	31.62%
2016	4.70%	0.28%	4.60%	5.00%	7.73%	6.76%	13.13%	5.62%	-	-	-	-	24.03%
2017	4.70%	0.28%	4.60%	5.00%	7.46%	6.33%	11.61%	5.30%	14.28%	6.00%	-	-	19.37%
2018	4.70%	0.28%	4.60%	5.00%	6.94%	5.96%	10.40%	5.03%	13.10%	6.00%	-	-	-
2019	4.70%	0.28%	4.60%	5.00%	6.49%	5.62%	9.42%	4.79%	12.13%	6.00%	-	-	-

Table 4-3: The summary of forecasting data among the 1st, 2nd, and 3rd Thai-Lao Friendship Bridges studies (Cont.)

Year	1st Friendship Bridge					2nd Friendship Bridge	3rd Friendship Bridge						
	Study 1				Study 2	Study 1	Study 1				Study 2		Study 3
	Trade value	Travelers	Vehicle		Vehicle	Vehicle	Case 1		Case 2		Travelers	Vehicle	Travelers
	Total	Total	Arrive	Depart	Total	Total	Import	Export	Import	Export	Total	Total	Total
2020	-	-	-	-	6.09%	5.32%	8.61%	4.59%	11.32%	6.00%	-	-	-
2021	-	-	-	-	5.74%	5.05%	7.93%	4.37%	10.63%	6.00%	Growth from 2017		-
2022	-	-	-	-	5.43%	4.81%	7.35%	4.19%	10.04%	5.99%	85.69%	85.63%	81.14%
2023	-	-	-	-	5.15%	4.59%	34.21%	20.12%	52.18%	33.82%	-	-	-
2024	-	-	-	-	4.90%	4.39%	25.48%	16.76%	42.54%	33.82%	-	-	-
2025	-	-	-	-	4.67%	4.20%	20.33%	15.00%	36.81%	34.00%	-	-	-
2026	-	-	-	-	4.46%	4.03%	-	-	-	-	Growth from 2022		-
2027	-	-	-	-	4.27%	3.88%	-	-	-	-	46.55%	46.57%	44.79%
2028	-	-	-	-	4.10%	3.73%	-	-	-	-	Growth from 2027		-
2029	-	-	-	-	3.94%	3.60%	-	-	-	-	32.51%	32.52%	-
2030	-	-	-	-	3.79%	3.47%	-	-	-	-	Growth from 2029		-

Table 4-3: The summary of forecasting data among the 1st, 2nd, and 3rd Thai-Lao Friendship Bridges studies (Cont.)

Year	1st Friendship Bridge					2nd Friendship Bridge	3rd Friendship Bridge						
	Study 1				Study 2	Study 1	Study 1				Study 2		Study 3
	Trade value	Travelers	Vehicle		Vehicle	Vehicle	Case 1		Case 2		Travelers	Vehicle	Travelers
	Total	Total	Arrive	Depart	Total	Total	Import	Export	Import	Export	Total	Total	Total
2031	-	-	-	-	3.65%	3.36%	-	-	-	-	25.10%	25.08%	-
2032	-	-	-	-	3.52%	3.25%	-	-	-	-	-	-	30.94%
2033	-	-	-	-	3.40%	3.15%	-	-	-	-	-	-	-
2034	-	-	-	-	3.29%	3.05%	-	-	-	-	-	-	-
2035	-	-	-	-	3.18%	2.96%	-	-	-	-	-	-	-
2036	-	-	-	-	3.09%	2.87%	-	-	-	-	-	-	-
2037	-	-	-	-	2.99%	2.79%	-	-	-	-	-	-	23.63%
2038	-	-	-	-	2.91%	2.72%	-	-	-	-	-	-	-
2039	-	-	-	-	2.82%	2.65%	-	-	-	-	-	-	-
2040	-	-	-	-	2.75%	2.58%	-	-	-	-	-	-	-
2041	-	-	-	-	2.67%	2.51%	-	-	-	-	-	-	-
2042	-	-	-	-	2.60%	2.45%	-	-	-	-	-	-	-
2043	-	-	-	-	2.54%	2.39%	-	-	-	-	-	-	-
2044	-	-	-	-	2.47%	2.34%	-	-	-	-	-	-	-

4.3 Comparison of International Trade Statistics at Thai-Lao Friendship Bridges

In order to measure trends across Mekong River, statistical data of trade at the bridges are concerned for studying the trend of cross border trade. Historical data of import and export were plotted to present the trend of border trade for each bridge. The data were provided by Bank of Thailand from year 2003 to 2014. Export trend of all Thai – Laos Friendship Bridge are increasing year by year. The trend of export in figure 4-1 shows that overall export rate among all the Friendship Bridge starts to increase dramatically in year 2009.

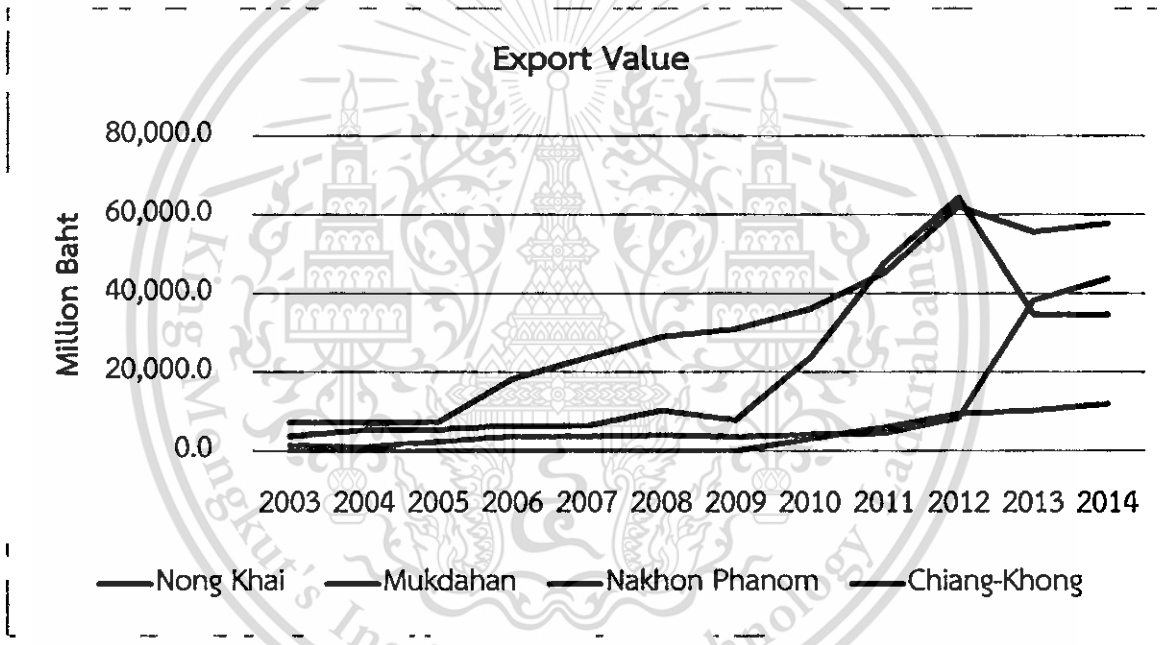

Figure 4-1: Export value of four Thai – Laos Friendship Bridge

There are many kind of goods transported between Thailand and Lao PDR cross border. Important export goods are consisted of oil products, notebook computer, computer, automobiles, trucks, excavator, and tractors components, inks, fresh fruits candies, and beverage.

4.3.1 Export value among Thai-Lao Friendship bridges

Overall trade volume of all Thai-Lao Friendship Bridges can represent the bridges performance and exporting potential of Thailand that have been continually growing significantly. At Nong Khai border checkpoint, export value increased and reached to peak in 2012 with the value above 60,000 million baht and dropped down a little below 60,000 million baht in a year after that. The overview export trends at Nong Khai from year 2003 to 2014 are significantly relying on good direction. Nong Khai Bridge ranked first in export trend when comparing with other bridges. However, in 2013 export volume at Nong Khai Bridge slightly dropped because the export amount of diesel and other finished oil decreased. Export value at Mukdahan Bridge started to greatly increase in year 2009 and exceeded Nong Khai in 2011. Then, it sharply increased in the following year before dropped down and remained with the value less than value of export at Nakhon Phanom. The fully operated of the 3rd Thai-Lao friendship bride at Nakhon Phanom is known as an important alternative of transportation between Thailand and Lao PDR. It is fully operate in year 2006. Six years after that export rate were dramatically increased, overtaking the value of Makdahan Bridge in 2013 and kept increasing. Meanwhile , export value at Chiang Khong started to rise steadily from year 2009 until 2014.

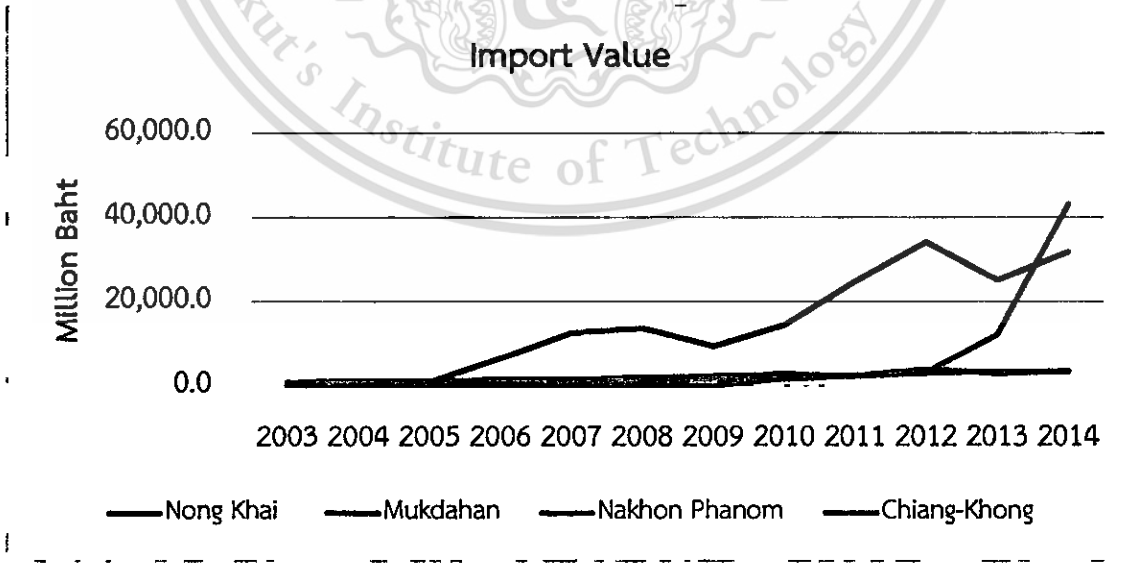

Figure 4-2: Import value of four Thai – Laos Friendship Bridge

4.3.2 Import value among Thai-Lao Friendship bridges

Important import goods from Lao PDR includes, copper, full set of radio calls, garments, Motorcycle accessories, lumber and etc. The import trends of each Thai – Lao Friendship Bridge has lower value when compare to its export trends. The trend of Mukdahan Bridge stands out than the other bridges with the highest import value until year 2013. It means that this bridge plays the most importance roles in term of import than the other bridges along the Mekong River. According to figure 4-2, in year 2012, There was a significantly change in import direction within this region. The import value in Mukdahan was reduced with the same amount of percentage increased at Nakhon Phanom. After that the import trends in 2013 at Nakhon Phanom Bridge has increased rapidly and exceeds Mukdahan Bridge as it continue to increase. The import trends of other bridges including Nong Khai and Chiang- Khong, both bridges have less import value. They are remaining at the value less than 5,000 million baht for each bridge.

4.4 Comparison of International Trade Statistics at Thai-Lao Friendship Bridges at the Initial Operating Year

Thai-Lao Friendship Bridges are collaboration of Thailand and Lao PDR to provide facilities along Mekong region. Although there are border trades activities between Thailand and Lao PDR around all of Thai-Lao Friendship Bridges, each Friendship Bridge poses different kinds of goods and transportation activities. As the Fourth Thai-Lao Friendship Bridge was just fully operated recently, there are not enough data for analyzing trend of trade border in order to accurately predict the future transportation trends. Thus, trade data of other Thai-Lao Friendship Bridges, in which have been operating for several years, were applied as a guideline for developing trend of trade direction. Trend of each Friendship Bridge was analyzed from data of its initial operating year until present. In addition, the trade data from Fourth Thai-Lao Friendship Bridge in last two years before the bridge was operated were included.

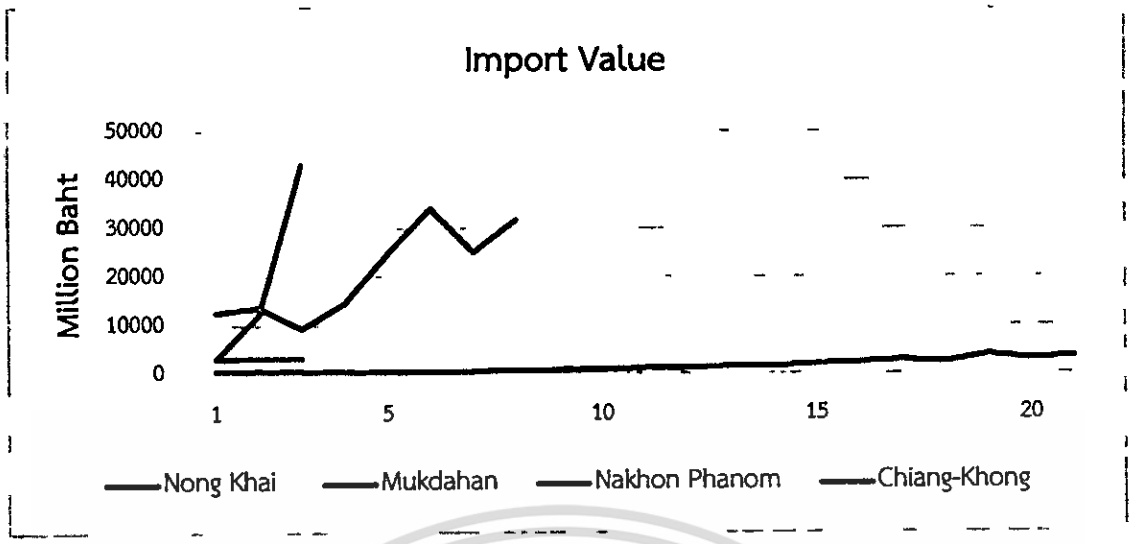

Figure 4-3: Trends of import value among Thai – Laos Friendship Bridges at opening year

Trends of import value in figure 4-3 can be classified into two groups; first is a group of upward trend including the 2nd Thai-Lao Friendship Bridges (Mukdahan) and the 3rd Thai-Lao Friendship Bridges (Nakhon Phanom). According to geographic data from both Friendship Bridges, there are advantages of locations which are closer to the special economic zone and sea port in Vietnam. The trends of trade value at these two borders are significantly related to economic situation. Another group is a group of moderate growth trend which includes; the 1st Thai-Lao Friendship Bridges (Nong Khai) and the 4th Thai-Lao Friendship Bridges (Chiang-Khong). The transportation trends at these two borders are considerably the same with a constant growth in an import value.

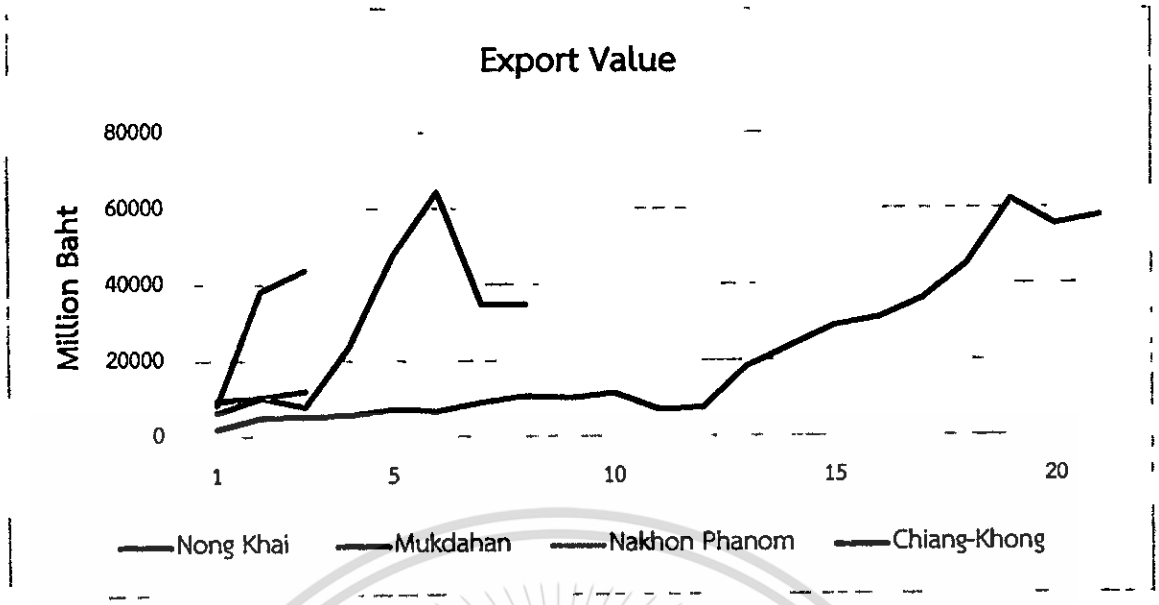

Figure 4-4: Trends of export value among Thai – Laos Friendship Bridges at opening year

Since, Mukdahan Bridge has potentially linked economic activities of Lao PDR and Vietnam along with East-West Economic Corridor. It is seen as a gateway to the South China Sea and a logistics hub for transporting products through Laos PDR and Vietnam along R9 route to the Da Nang port of Vietnam. Moreover, Mukdahan Bridge is an important gateway to the North-East of Thailand and is connected to Savannakhet district in Lao PDR, which is the second-largest province of Lao PDR. For Nakhon Phanom border, its export trend has been growing rapidly because entrepreneurs in Thailand started to use the R12 route for transporting fresh fruits from Thailand to the China's market. Furthermore, it is a shorter route than R9 and R3E (Highway Kunming - Bangkok), which link Chiang-Khong to Kunming. So, the R12 route helps reduce transportation costs. The R12 route has been accepted as an important route for transportation across border. It is also known as an important route for export and import of goods to third country. From this reason, after the 3rd Friendship Bridge was opened, it became an alternative for transportation and had shared the export value from Mukdahan. Thus, export trend of Mukdahan Bridge is inversely proportional to Nakhon Phanom Bridge. For Nong Khai Bridge, the export volume continues as an upward trend because the infrastructure was developed for supporting the explanation of economy along Mekong regions over 20 years. So,

Nong Khai Bridge has a potential to support demand from other countries. In addition, it is located near the center of economy in Lao PDR (Vientiane). It is also being a significant hub linked the economies within the regions along the North Southern Economic Corridor: (NSEC) and the Eastern Economic Corridor (EEC) with cooperation of Greater Mekong Sub-region (GMS). The export trend of Chiang-Khong Bridge is similarly to Nong Khai Bridge's as it has been gradually increasing. Although the export trend of Chiang-Khong Bridge increased slowly comparing to the bridge that was recently opened such as Nakhon Phanom Bridge, the export value at Chiang-Khong Bridge has an opportunity to grow parallel with the expanding economy of South-China because of the connected R3A route which is important linkage transportation to South-China.

4.5 Transportation trend at the 4th Thai - Lao Friendship Bridges

In order to clarify the characteristic of transportation at the 4th Thai - Lao Friendship Bridges, the number of vehicle arrival and departure at the bridge are necessary to be observed.

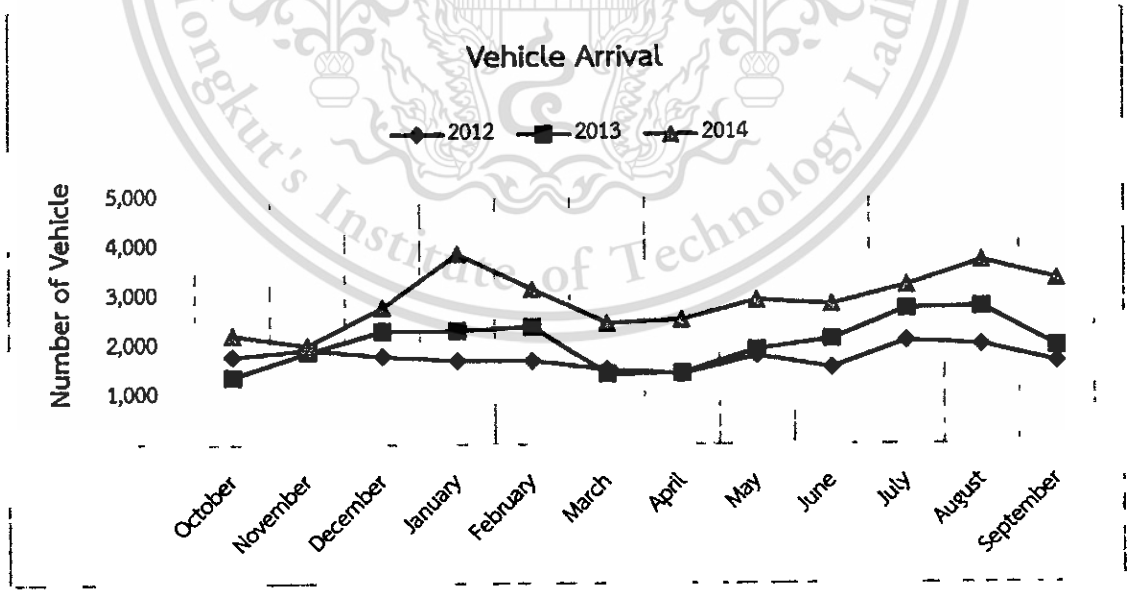

Figure 4-5: Trend of vehicle arrival through Chiang-Khong custom

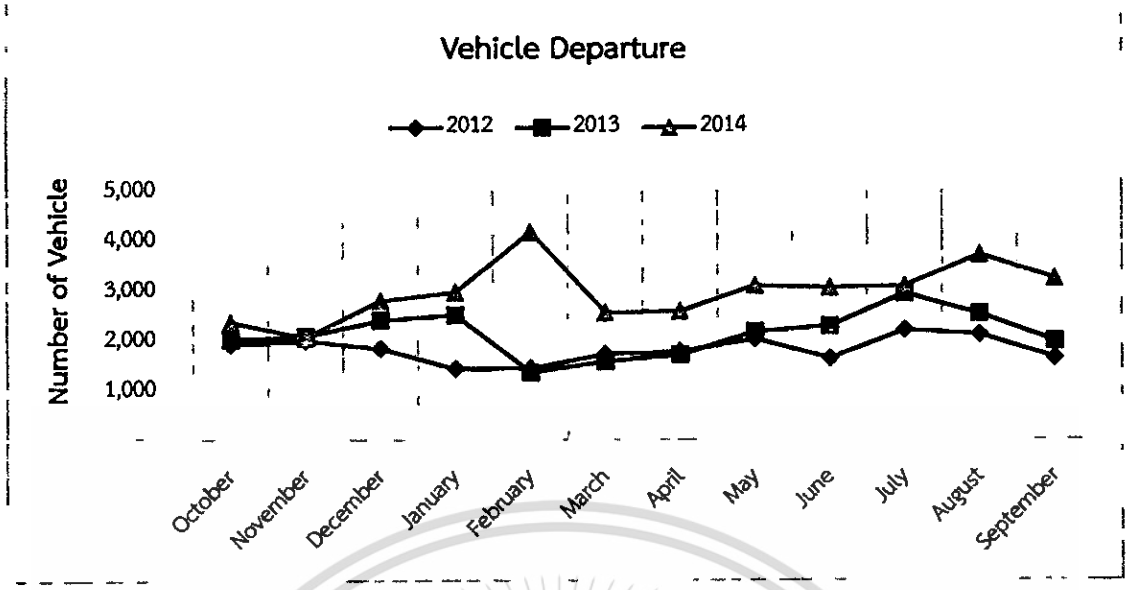

Figure 4-6: Trend of vehicle departure through Chiang-Khong custom

Figure 4-5 and Figure 4-6 show the trend of departure and arrival at Chiang-Khong custom. The vehicle data were used to compare month by month based on the budget year 2012 to 2014. According to the graphs, transportation activities at Chiang-Khong are seasonal. Moreover, this can be supported by the study of Port Authority of Thailand (PAT) which also concludes that transportation behavior at Chiang-Khong is a seasonal trend. As the graphs show, the trend of transport in both graphs reach maximum point around January and February, after they go up again around July and August in every year. In year 2014, it can be clearly seen that transport at Chiang-Khong is a seasonal trend. Moreover, the amount of vehicles is the highest in this year comparing to the other years.

Table 4-4: Top 10 import and export products at four Friendship Bridge

Ranking	The 1st Thai-Lao Friendship Bridge		The 2nd Thai-Lao Friendship Bridge		The 3rd Thai-Lao Friendship Bridge		The 4th Thai-Lao Friendship Bridge	
	Import	Export	Import	Export	Import	Export	Import	Export
1	Pickup cars with diesel engines not exceeding 3000 cc						Vegetable	
2	Upper components of shoe(BOI)	Pick-up truck and lorry		Motorcycles		Energy drink	Fresh fruit	Consumer goods
3		Travelers cars and trucks					Machinery - Equipment	Fresh fruit
4			Machinery	Fresh fruit	ISO tank	Fresh fruit	Flowers, ornamental	
5	4 doors pickup truck 3,000 cc (FreeZone)		Ready-made clothes and accessories	CBU cars	Offshore and fully equipment	Dried Longan	Argon Gas	

Gasoline Vehicles Electronic Goods Raw Materials Finish Goods Agriculture Products.

Table 4-4: Top 10 import and export products at four Friendship Bridge (Cont.)

Ranking	The 1st Thai-Lao Friendship Bridge		The 2nd Thai-Lao Friendship Bridge		The 3rd Thai-Lao Friendship Bridge		The 4th Thai-Lao Friendship Bridge	
	Import	Export	Import	Export	Import	Export	Import	Export
6	Van with engines not exceeding 2500 cc (FreeZone)		Motorcycles	Tank / Empty Tank	n/a	n/a	Cigarette	
7	Children's book	Beverages (no alcohol)	Fertilizer	Consumer goods	n/a	n/a	Dried tobacco leaves	Almonds, Dried walnuts, Incas
8	Electric transformers			Reader Computer Components	n/a	n/a	Honey	Dried Anchovy
9	Tobacco leaves	Tractors			n/a	n/a		Personal car
10	Motorcycles (FreeZone)	Grinding ball			n/a	n/a	Tractor Head	

Gasoline Vehicles Electronic Goods Raw Materials Finish Goods Agriculture Products.

According to table 4-4, the sorts of products transported across the Mekong River among all the Friendship Bridges are different. The products can be classified into six types including; gasoline, vehicles, electronic goods, raw materials, finish goods, and agriculture products. The 1st Friendship Bridge is mainly responsible for many type of vehicles in both import and export direction. Raw material and electronics goods are most shipped at the 2nd Bridge. According to the data at the 3rd Friendship Bridge, this gateway is an important route for electronic and finished goods. However, the data are available only the first five products transported at this border checkpoint. Meanwhile, most of agriculture products ship across the Mekong River through the 4th Friendship Bridge as a main route. Thailand has been importing vegetable, fresh fruit, and flowers and ornamental and export fresh fruit through this bridge. In summary, each bridge has different characteristics for transportation of products.

4.6 Analysis of Results and Forecast

In order to determine the most appropriate method for forecasting trend of cross border including the trade values, number of travelers, and number of vehicles for future research, results from previous studies were needed to be determined. This research was aimed to observe the difference between actual data and forecast data from the different forecast technique in the studies related to the border crossing over Mekong River. Results from comparisons can be summarized into 3 sections including; 1) the comparing forecast and actual percentage growth of the 4th Thai – Lao Friendship Bridge, 2) the comparing forecast and actual percentage growth of the other Thai – Lao Friendship Bridges, and 3) compared growth trend among Thai – Lao Friendship Bridges.

4.6.1 Trade Value

Due to the expanding of business economy among Mekong region, trade value is one of the most important indicator that is mostly concerned. Cross border trade represents popularity of import and export across the bridges and facilities of cross border trading.

According to the comparison of trade value at the 4th Thai-Lao Friendship Bridge, the forecasted data are not close to percentage growth of actual data. However the trends of import and export value at this bridge, which are represented in the figure 4-1, 4-2, 4-3, and 4-4, tend to grow steadily. The comparison of trade among other Thai-Lao Friendship Bridges shows that the percentage growth of forecasted data also deviates from the actual growth. Furthermore, Trading trends of all Thai-Lao Friendship Bridges are an upward trend especially in the 2nd and 3rd Thai-Lao Friendship Bridges.

4.6.2 Number of Vehicle and Travelers

Thailand is known as a well-known travel destination. Travel industry is one of the most significant industries that create a major value for Thai economy. Vehicles travelling through the Friendship Bridge include trucks, buses, and private vehicles. However, the characteristic of vehicle travel across the border at every Friendship Bridges is significantly the same. The number of arrival and departure are in the same level. The forecast of vehicles across the border were made in order to identify the trend of transportation across countries.

The comparison number of vehicles and travelers of the 4th Thai-Lao Friendship Bridge (study2) show that the actual percentage growth of both factors tends to increase continuously. When compare with actual percentage growth, the predicted results are a lot less than the actual data. For the comparison of other bridges, the forecasted results of departing vehicle at the 1st Thai-Lao Friendship Bridge and total vehicle at The 3rd Friendship Bridge are close to the actual data than the other cases. As results, transportation activities are significantly grown much higher than the forecasted value of each study. Thus, the development Thai-Lao Friendship Bridges is very important to support expansion of bridges in the future.

Chapter 5

Conclusion and Future Works

5.1 Conclusion

This study aims at investigating previous studies for measuring the trade and transportation trends at all Thailand and Lao PDR bridges. The researcher studied on the secondary data and report related to the Friendship Bridge. A number of studies on other border bridges are conducted to identify the direction and trends of transportation at cross border. Due to the fully operated period at the Fourth Friendship Bridge, it is important to study on the growth and effects of this bridge with the cross border situation. Thus, this research is conducted to visualize on similarity and difference of the transportation trends between the Fourth Thai-Lao Friendship Bridge and other Thai-Lao Friendship Bridges. Moreover, the result of this research is expected to evaluate the forecasting data from the governmental institute. In order to efficiently develop a research, an identification of forecasting technique is necessary to calculate the transportation trend at Thailand and Lao PRD cross border.

Chiang-Khong Bridge is the newest border bridge for Thailand and Lao PDR cross border for road transportation. Thus, it is possible to prepare for handling an increasing of transportation in future situation by studying on the previous research related to the cross border transportation at the Friendship Bridges. In the other hand, it is difficult to clearly identify the transportation trend at the Fourth Friendship Bridge due to the limitation of historical data. However, the Econometric Model with Microscopic Qualitative Analysis can provide an accurate forecasting results for the development of Chiang-Khong cross border.

In addition, the forecasted trends of the Fourth Friendship Bridge are significantly high because of the increasing in transportation trends of the 2nd and 3rd Friendship Bridge. Nevertheless, the actual data of Chiang-Khong Bridge shows that

the forecasted data in previous studies are over predicted. The results of this research explored that the forecasted data need to be re-concluded. The strategies and plans developed within Chiang-Khong area for supporting the transportation at cross border may need to be reexamined.

Base on the historical data, transportation trends at Chiang-Khong, it is considerably similar to the characteristics of Nong Khai cross border. Import and export value are continue to increase constantly. Therefore, Chiang-Khong should concern on the development of the 1st Friendship Bridge. Furthermore, the forecasted data at Chiang-Khong also support that the growth rate at the Fourth Friendship Bridge is going to increase constantly. However, the sorts of products transporting through the 1st and 4th Friendship Bridges are significantly different. This is one of the point that researcher should concern. Then policy makers and governmental institutes should prepare to support the development of the economy within the region. Since Chiang-Khong is an important route for transportation among China, Lao PDR, and Thailand, the dramatically increase in the development of China economy should be considered to develop a plan for Chiang-Khong cross border development.

The trends and overall transportation across Thai – Laos borders can represent that the trading trends of all Thai-Lao Friendship Bridges are an upward trend especially in the 2nd and 3rd Thai-Lao Friendship Bridges. According to the types of products that transported across other Friendship Bridges are also effected to the trade value because each type of product has disparity of value and characteristic. Moreover, transportation activities also tend to increase because each Friendship Bridge is connecting an importance route to Lao PDR and other countries such as R3a route, R9 route, and R12 Route.

Unfortunately, the historical data provided in the previous study is limited, it is not possible to identify the forecasting method in some specific studies. Thus, the analysis of the previous study are mostly consider on qualitative analysis.

5.2 Future Works

Unfortunately, the Fourth Friendship Bridge was fully operated in the end of 2013, thus the availability of historical data are limited. Then the trade and transportation trends defined in this research are based on the historical data which may not enable to measure the overall trend for Chiang-Khong cross border. Thus, most data should be collected and concerned for developing the research of cross border at Chiang-Khong in the future. Moreover, the availability of secondary data will allow the researcher to employ a multiple regression to better evaluate the significant relationship between actual data and forecasted data.

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