

Road Transportation Management Potentiality Enhancement for Linking Special Economic Zones and Border Trade Activities in Mukdahan Province, Thailand

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Abstract— The purpose of this article is to study the knowledge, to create a model for improving the Road Transportation Management Potentiality for linking the special economic zone and border trade in Mukdahan province, Thailand, and to study the effect of increasing the potential of road transport management on business performance. Mixed research method was used. The sample was 316 road freight entrepreneurs in the border economic and trade areas in Mukdahan province, from a population of 1,500 people, including 12 interviewees. Data were collected by using questionnaires and interview forms. The data gathered was tested by using various statistical techniques to ensure that the information is reliable and accurate in Structural Equation Modeling (SEM). The results found that increasing the potential of road transport management for linking special economic zones and border trade in Mukdahan province with Inbound-Outbound Transportation (IOT) had a direct positive impact on Performance of Firm Management (PFM), with the three most important capabilities: security, documentation procedures, and vehicle management, whereas the three most outstanding results are cheaper, faster, and better. To implement this model, entrepreneurs, therefore, need to give first priority in developing operational manuals such as safety standard transportation manual, customs clearance from Mukdahan province to Laos PDR manual, and vehicle management manual.

Keywords—*transportation; road transportation management; potentiality enhancement; special economic zones; border trade activities*

1. Introduction

Road transportation management is the most widely used transportation in Thailand by transporting goods from the main road through the secondary road (local roads). The road transportation has few links to other modes of transportation in Thailand. However, although road transportation in Thailand still has low potential and more than 10% transportation costs, it still plays an important role in the Thai economy, especially in the special economic zones and border trade that should be watched, such as Mukdahan province in the central northeastern

group. Thai government has declared Mukdahan as special economic zone and border trade [1] to promote trade, investment, tourism, logistics center, and transportation to ASEAN countries. The main transportation route - Highway 212, Mukdahan to Ubon Ratchathani - that connects to the ASEAN transportation route - R9, Mukdahan-Savan, Lao PDR - is used. Mukdahan is a border town of the Mekong River Basin and frontier town for the Thai-Lao border trade. It drives the economy and tourism with cross-border transportation from Thailand to Lao PDR, Vietnam, and southern China, for example, carrying goods by truck across the 2nd Thai-Laos Friendship Bridge (Mukdahan-Savannakhet), with the lengths of 1.6 kilometers to Savannakhet of Lao PDR, the important location for legitimate gambling tourists in the Savan Vegas Casino travelling mainly by van of Lao PDR.

At present, the problems of road transportation management to connect the special economic zone and border trade in Mukdahan province comprise 2 main areas. First, inbound road transportation problems in delivering products from other provinces to Mukdahan via 4 main routes - Ubon Ratchathani to Mukdahan, Nakhon Phanom to Mukdahan, The Doltan-Mukdahan, and Savannakhet to Mukdahan - encounter the main problems in vehicle management, driver management, route management, operational process design, and security. Second, outbound road transportation problems in delivering goods from Mukdahan province over the 2nd Thai-Laos Friendship Bridge heading to Savannakhet, Lao PDR portrays the key problems with vehicle restrictions, government measures, documentation procedures, and information management. These problems have a negative impact on the performance of Thai road freight entrepreneurs, resulting in poor service quality, delay transportation, high transportation costs, and poor customer relationships. In addition, these also affect the competitiveness of Thai logistics service provider (LSP) that is lower than the Lao PDR LSP. It found that both inbound and outbound transportations by Lao PDR LSP are more popular than those by Thai LSP since they are more convenient, faster, and more agile.

This affects the overall picture of Thailand economy. In addition, it found that although Mukdahan province is the special economic zone and border trade town, there are more inbound freights rather than outbound freights, resulting a balance of trade deficit by 1,345.19 million baht [2].

2. Hypotheses and Review

2.1 Hypotheses

H1: Road Transportation Management Potentiality Enhancement with Inbound-Outbound Transportation (IOT) has a direct positive effect on Performance of Firm Management (PFM)

2.2 Transportation Management Potentiality Enhancement

2.2.1 Potentiality Enhancement

Potentiality has the same meaning as efficiency. It is the ability to achieve the goal with the minimum resources. In other words, it is defined as an effective resource allocation. In general, operational performance often means an ability to work efficiently [4]. Potentiality, derived from Greek and Latin language, is consistent with the capacity and ability. Potentiality Enhancement, therefore, is also known as the capability enhancement. It is a way to help the company to operate, control, and manage efficiently. It is also an approach to increase competitiveness or gain competitive advantage [5]. In conclusion, potentiality enhancement means to increase the existing competitiveness in order to benefit the business operations.

2.2.2 Transportation Management

It is a planning, control, and management of transportation by moving goods from one location to another using vehicles, tools, equipment, resources, and transportation facilities to achieve objectives. Physical movement is emphasized to reduce transportation costs, improve quality,

comprises Routing Management [11] [12] Operational Process Design [13], Security [12], Coordination [14]; [15], Preparedness [16], Information Management) [17]; [18]; [19], and Documentation Procedures.

2.3 Performance measurement of entrepreneurs

The performance can be measured using various indicators, for example, SCOR Model, Balanced Scorecard (BSC), and financial and non-financial indicators. Logistics Measurement [3], however, is suitable for measuring the performance of road transpiration entrepreneurs. Martin (2016)'s four logistics indicators consist of:

- *Better*: Better quality of service will increase business efficiency and competitiveness. However, the

develop service levels of LSP, and deliver safety and completed products on time. Transportation is a part of Logistics [6] that focuses on management of material flow and information flow in the activities of storage, collection, movement and distribution [7]. However, for the 6 modes of transportation - land, water, air, rail, pipeline, and multimodal transportation-, Thailand mostly relies on land transportation by truck.

2.2.3 *Road Transportation Management Potentiality Enhancement* means developing an existing capacity of road transportation to benefit the business operations by improving the ability in an inbound-outbound road transportation management. In the case of Mukdahan province, Thailand, it refers to the movement of goods from other provinces to Mukdahan via 4 main routes - Ubon Ratchathani to Mukdahan, Nakhon Phanom to Mukdahan, The Doltan-Mukdahan, and Savannakhet to Mukdahan. While, outbound road Transportation is defined as the movement of goods from Mukdahan past the border crossing and 2nd Thai-Laos Friendship Bridge to Savannakhet, Laos PDR by arranging inbound and outbound road transportation. Inbound and outbound road transportation needs to build capacities related to government measures, the policy promoting the development of transportation links within the ASEAN region, taxation privileges in border areas and customs, the right to transport goods in a special economic zone [8]. In addition, transportation laws are important [8]. Good infrastructure connection, furthermore, lowers transportation costs [9] and is the important key in ASEAN integration so as to facilitate the movement of products and services as well as support trade and international transportation in all modes – rail, road, air, sea, multimodal transportation - [10], including vehicle management. Driver management is also one of the indicators the Department of Land Transport use as a criterion for evaluating the quality of road transport entrepreneurs in requesting Q-Mark certification. Apart from Driver Management, other enhancement approaches

challenges of high international competition have led the company to "go global". Local businesses must fight for maintaining the balance between local and global trade, gather experiences, and increase competitiveness to survive their businesses. Trade efficiency will support business operational goals [20], including better operations that can reduce shipping errors, disruption, and transportation management problems.

- *Faster*: Faster Transportation and operation allow the company to adjust existing resources faster than competitors [21]. Transportation efficiency can be increased by reducing time cycle or lead time, improving responsiveness speed, and moving products to the destination in a timely and faster manner. These will help the firm to create trade opportunities.

- *Cheaper*: Expenses, prices, and transportation costs are cheaper than competitors.
- *Closer*: The firms that have a closer relationship with customers will be able to retain their clients. This is a generally accepted rule with the principle that retaining customers is cheaper than finding customers [22].

3. Methodology

Mixed method between quantitative and qualitative research[23] was used in this study. The population was 1,500 road transportation entrepreneurs in Mukdahan economic area and border trade. The sample of 316 truck transportation entrepreneurs used in quantitative study comprised 4-wheel, 6-wheel, 10-wheel, and 18-wheel or trailer truck transportation entrepreneurs. Purposive sampling was used to select 12 interviewees from 6 companies and 10 companies in experimental study. Research instruments were the questionnaire and interview

form. The questionnaire was examined by 5 experts, with IOC=1 and reliability of 0.89. Descriptive statistics, such as Pearson's Product-Moment Correlation Coefficient, Simple Regression Analysis, Multiple Regression Analysis, Structural Equation Modeling (SEM), and Path Analysis were used to analyze the data. Finally, the model was confirmed from 12 entrepreneurs in terms of the practical suitability.

4. Results

4.1 Construct Validity of Measurement Model

Table 1. Correlation matrix, means, and standard deviations of observed variables of the Model on Road Transportation Management Potentiality Enhancement by Inbound-Outbound Transportation (IOT)

	IOT_GM	IOT_VM	IOT_DM	IOT_RM	IOT_OP	IOT_SC	IOT_CD	IOT_PP	IOT_DI	IOT_DP
IOT_GM	1									
IOT_VM	0.350**	1								
IOT_DM	0.350**	0.759**	1							
IOT_RM	0.268**	0.778**	0.744**	1						
IOT_OP	0.374**	0.696**	0.739**	0.793**	1					
IOT_SC	0.386**	0.692**	0.727**	0.722**	0.792**	1				
IOT_CD	0.536**	0.608**	0.580**	0.530**	0.581**	0.571**	1			
IOT_PP	0.556**	0.603**	0.579**	0.512**	0.627**	0.637**	0.799**	1		
IOT_DI	0.600**	0.561**	0.553**	0.489**	0.652**	0.653**	0.726**	0.790**	1	
IOT_DP	0.443**	0.664**	0.659**	0.576**	0.656**	0.632**	0.667**	0.720**	0.773**	1
\bar{X}	3.85	4.55	4.58	4.59	4.35	4.35	4.36	4.26	4.11	4.27
S.D.	0.61	0.50	0.49	0.47	0.48	0.47	0.58	0.55	0.56	0.55

Bartlett's test of Sphericity Chi-Square = 3093.448, df = 45, P-Value = 0.000, KMO = 0.905

Note: * P-Value < .05 ** P-Value < .01

Table 2. Correlation matrix, means, and standard deviations of observed variables of the Model on Performance's Road Transport Entrepreneurs in the View of Performance of Firm Management (PFM)

Variables	PFM_BT	PFM_FT	PFM_CP	PFM_CS
PFM_BT	1			
PFM_FT	0.475**	1		
PFM_CP	0.493**	0.786**	1	
PFM_CS	0.414**	0.648**	0.728**	1
\bar{X}	4.39	4.20	4.28	4.32
S.D.	0.56	0.56	0.58	0.62

Bartlett's test of Sphericity Chi-Square = 759.442, df = 6, P-Value = 0.000, KMO = 0.749

Note: * P-Value < .05 ** P-Value < .01

4.2 SEM Analysis Results

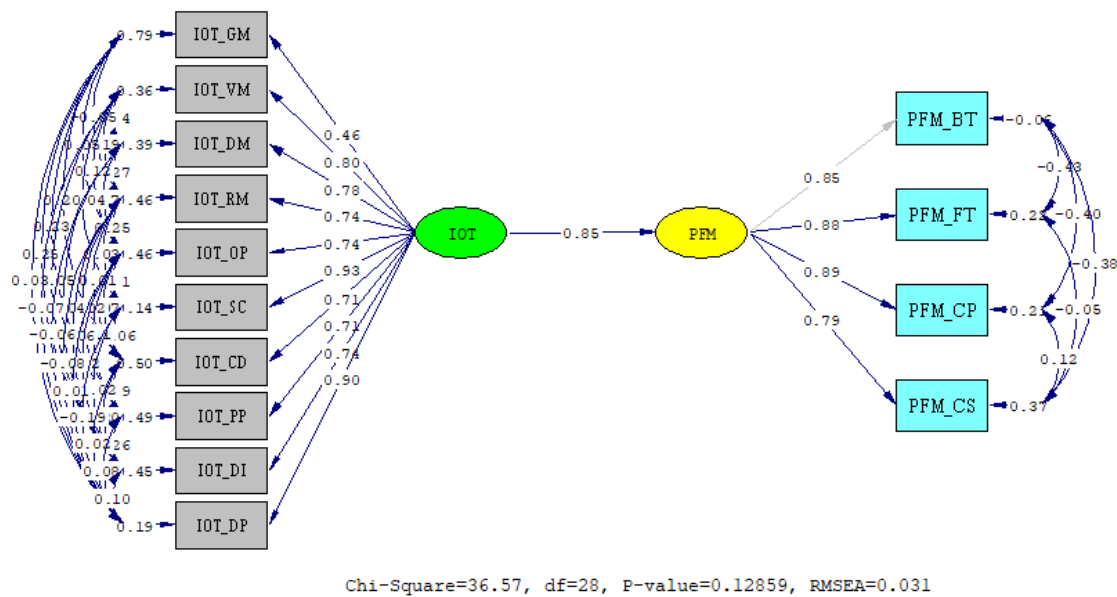


Figure 1. Structural Equation Model Fit Index Analysis

4.3 Path Analysis Results

Table 3. The Analysis of variables' effects in IOT model

Model	IOT					
	TE	DE	IE			
PFM	0.85** (0.05) 18.03	- - -	0.85** (0.05) 18.03			
Chi-Square = 36.57, df = 28, P-Value = 0.13, GFI = 0.98, AGFI = 0.94, RMR = 0.006						
Variables	PFM_BT	PFM_FT	PFM_CP	PFM_CS	IOT_GM	IOT_VM
Construct Reliability	0.96	0.78	0.79	0.63	0.21	0.64
Variables	IOT_DM	IOT_RM	IOT_OP	IOT_SC	IOT_CD	IOT_PP
Construct Reliability	0.61	0.54	0.54	0.86	0.50	0.51
Variables	IOT_DI	IOT_DP				
Construct Reliability	0.55	0.81				
Structural Equation	PFM					
R Square	0.72					
Correlation Matrix between Latent variables						
Latent variables	PFM	IOT				
PFM	1.00					
IOT	0.85					

Note: * P-Value < .05 ** P-Value < .01

5. Discussion

(1) For Road Transportation Management Potentiality Enhancement by Inbound-Outbound Transportation (IOT), the most important variable that is Security (IOT_SC) with standardized factor loading of 0.93 and variance with Road Transportation Management Potentiality Enhancement by

86%, followed by Documentation Procedures (IOT_DP), with standardized factor loading of 0.90 and variance with Road Transportation Management Potentiality Enhancement by 81%, Vehicle Management (IOT_VM) with standardized factor loading of 0.80 and variance with Road Transportation Management Potentiality Enhancement by 64%, Driver Management (IOT_DM),

with standardized factor loading of 0.78 and variance with Road Transportation Management Potentiality Enhancement by 61%, Data and Information Management (IOT_DI), with standardized factor loading of 0.74 and variance with Road Transportation Management Potentiality Enhancement by 55%, Routing Management (IOT_RM) and Operation Process Design (IOT_OP), with standardized factor loadings of 0.74 and variances with Road Transportation Management Potentiality Enhancement by 54%, Preparedness (IOT_PP) with standardized factor loading of 0.71 and variance with Road Transportation Management Potentiality Enhancement by 51%, Coordination (IOT_CD) with standardized factor loading of 0.71 and variance with Road Transportation Management Potentiality Enhancement by 50%, and Government Measures (IOT_GM) with standardized factor loading of 0.46 and variance with Road Transportation Management Potentiality Enhancement by 21%, respectively. This is to say, Road Transportation Management Potentiality Enhancement to link the Special Economic Zone and Border Trade in Mukdahan Province (IOT) has three most important factors:

- Security: IOT_SC (0.93). When considered in details, the study found that good safety supervision methods for preventing road accidents / driver negligence / vehicle defects which can help to reduce damage to products or services and / or to life and property is most important

with a value of 4.62. Increasing the truck breakpoints along the main shipping routes, helping to increase the safety of the driver to stop when tired or drowsy, and the car breakpoints, helping to increase safety more than parking on the side of the road, including reducing hazards and accidents for road users and others is second most important with a value of 4.60. The security during road

- the interview results which found that for documentation procedures, if government organizations can reduce the steps of documentation procedures of road transportation in the movement of goods from Mukdahan province across the border, it will be able to help transportation entrepreneurs to reduce waiting time. In addition, by reducing the steps of documentation procedures of road transport in the movement of goods from Mukdahan province through the border, it will help to increase the transportation efficiency, comprising improvement of operational procedures for import and export documentations plus the contact with customs or border without the delay caused by waiting. While applying online information systems in customs is still unavailable in Mukdahan province. However, if government organizations adopt all systems faster, it would be good.
- Vehicle Management: IOT_VM (0.80). When considered in details, the study found that the correct resource placement which leads to the increase in transportation management efficiency is most important with a value of 4.59. Second, the suitable vehicle and transportation equipment selections plus the readiness of facility management is second most important with a value of 4.58. Third, the appropriate resource allocation and selection which leads to improvement of transportation operational flexibility is third most important with a value of 4.55. Forth, scheduling software which can help to plan the product delivery efficiently, such as methods of product

transport which helps to increase transportation efficiency and paying attention to weather conditions, such as heavy rain, sliding roads is third most important with a value of 3.97. These are in line with the results of the interview which found that goods are safe during transportation but they are damaged. Regarding the weather condition (such as heavy rain), the company will take into consideration every time before releasing the car due to the awareness of the safety of the car, people, goods from the accident. In addition, the transportation routes in Mukdahan should add more truck breakpoints for parking cars along the main shipping routes to increase the safety of the drivers. Currently, there are very few car stops. As for safety supervision methods for preventing road accidents or driver negligence or vehicle defects, the company is very attentive as it is an important factor to help to reduce damage to products or services to life and property.

- Documentation Procedures: IOT_DP (0.90). When considered in detail, the study found that the reduction of documentation procedures of road freight in the movement of goods across the border to Mukdahan province is most important with a value 4.37. Second, the application of online information systems in customs which helps to reduce document processing time and returned incomplete documents, including sending new documents quickly which can solve road freight operation problems is second most important with a value of 4.31. Third, the improvement of import and export documentation procedures, as well as contact with customs or border, which helps to reduce the delay caused by waiting is third most important with the value 4.23. Forth, the reduction of documentation procedures of road transportation in the movement of goods from Mukdahan through the border areas is forth most important with the value 4.16. These are consistent with collection per truck or multiple vehicles, and solve the problems of product loading in the truck is forth most important with a value of 4.54. Finally, the readiness of equipment for lifting, handling, and conveying which helps to speed up transportation operation is fifth most important with a value of 4.49. These is in relation to the interview results which found that vehicle management by selecting vehicles and transportation equipment that are appropriate for the quantity of products for conveying within the Mukdahan province can help to increase transportation efficiency. Nevertheless, the transportation of goods from Thailand across the border to Laos PDR has limitations on the size and weight (ton) of the truck. In addition, the methods of product collection per truck or multiple vehicles help to solve the problems of cargo loading in the truck by resulting in the full product loading and less wastage in transportation per trip with still maintaining good response time for customers. Besides, the readiness of facility management, sometimes, has restrictions regarding transportation equipment, such as not enough wheelbarrows attached to a truck or forklifts, making waste on human labor. It also takes more than 30 or 90 minutes to load the products in a 10-wheel truck, including 2-4 workers per vehicle. The availability of tools and equipment for lifting, loading and conveying can increase the speed of transportation operations. Nonetheless, the unavailability is due to insufficient tools or equipment. The suitable resource allocation and selection leads to

improvement in transport operation flexibility. Furthermore, there is no problem in choosing the appropriate tools because the staff has sufficient expertise. The right resource positioned can help to increase transportation management efficiency, such as arranging parking areas or cargo lanes. In the case that there are multiple products handled at the same time, the parking position affects the time and speed, as well as the convenience for moving the goods into the warehouse. However, the interview found the different results. It portrays that the scheduling software is not used in delivery planning. The entrepreneurs, moreover, do not realize that it can help to increase transportation efficiency because transportation scheduling is very conditional. The delivery planning still relies on manual work systems.

However, this finding corresponds to Q-Mark standard developed by Department of Land Transport, [13] [12] [14] [15] [16] [18] [17] [19]. Nevertheless, research results show that government measures (IOT_GM) are not significant to IOT and have no positive impact on Performance of Road Transportation Entrepreneurs (PFM). These findings differ from [8] [24], [10]

In summary, for implementing this model, entrepreneurs need to give the first priority in developing operational manuals, such as the Transportation Safety Standard Manual, Manual for customs clearance from Mukdahan

- Faster: PFM_FT (0.88). When considered in details, the study found that improving the response speed performance better than that before by moving products to their destination at the right time and faster which helps to create trade opportunities is most important with a value of 4.29. Second, faster transportation and operation than those before or those of competitors is second most important with a value of 4.20. Third, the ability to increase the transportation efficiency with the reduction of time cycle or lead time to deliver goods to customers faster is third most important with a value 4.19. Finally, the ability to adjust the available resources faster than that of competitors is forth most important with a value of 4.14. These are consistent with the interview results which found that Faster helps to work systematically and step by step. Therefore, transport operation is faster, although it may not be comparable with that of competitors.

- Better: PFM_BT (0.85). When considered in details, the study found that better operation which can reduce errors, disruption, and bottle neck problems in transportation management is most important with a value of 4.49. Second, increasing competitiveness to survive and grow business, create commercial efficiency, and support business goals is second most important with a value of 4.37. Third, the better quality of service which helps to improve transportation efficiency and enhance competitiveness is third most important with a value of 4.31. These are along with the interview results which found that better quality of transportation services is represented after applying. "The Model on Road Transportation Management Potentiality Enhancement for Linking Special Economic Zones and Border Trade Activities in Mukdahan Province (IOT)" helps the company to improve the quality of transportation services when compared to that in the past. However, it cannot be

province to Laos PDR, and Vehicle Management Handbook.

(2) For Performance of Road Transportation Entrepreneurs in the view of Performance of Firm Management (PFM), the most important variable is Cheaper (PFM_CP) with standardized factor loading of 0.89 and variance with Performance by 79%, followed by Faster (PFM_FT) with standardized factor loading of 0.88 and variance with Performance by 78%, Better (PFM_BT) with standardized factor loading of 0.85 and variance with Performance by 96%, and Closer (PFM_CS) with standardized factor loading of 0.79 and variance with Performance by 63%, respectively The three most important PFMs are:

- Cheaper: PFM_CP (0.89). When considered in details, the study found that the transportation of goods at a cost lower than that before or that of competitors is the most important with a value of 4.33. The expenses are cheaper than those before or those of competitors is the second most important with a value of 4.25. The findings are in line with the results of the interview which found that cheaper is the ability of company to reduce some transportation costs or expenses. However, transportation costs can be reduced for customers in some periods.

compared with that of competitors from Lao PDR or China. In order that whether competitiveness is increased or not, it is still considered as the first step to improve transportation management which made the company to perform better than that in the past. The above findings on performance (PFM) are in line with [3].

6. Conclusion

For suggestions on the research result implementation, road transportation entrepreneurs in Mukdahan province should develop the operational manuals, such as the transportation safety standard manual, manual for customs clearance from Mukdahan to Lao PDR, and vehicle management Manual. The manual development must be first priority and these manuals must be tried out for evaluating the results. After that, the driver management manual should be developed in terms of transportation route management methods for conveying large quantities of products and saving economies of scale, including the shortest distance. The standardized operational process should be designed for internationalization. The security system to protect products and property form damage should be available to avoid other negative consequences, such as increasing costs, customer dissatisfaction, and customer loss. The details of formal and informal forms of coordination should be specified clearly. Preparedness is important before the actual operation begins. The document storage system for customs clearance procedures should be developed. In addition, employees in all sectors should be trained so that they acquire the above knowledge.

Future Research Direction

1) The researcher should spend more time in repeating testing the model and collect the results again for the confidence.

(2) In-depth study should be conducted in terms of types and limitations of vehicles for cross-border transportation between Thailand and Lao PDR.

(3) Comparative study on Thailand and Lao PDR cross-border transportation system by passing second Thai–Lao Friendship Bridge should be focused.

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