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Multimodal transport in Vietnam in relationship with ASEAN countries : a case study of routes Thailand-Cambodia-Vietnam and Laos-Singapore

Thi Bich Bui
World Maritime University

WORLD MARTIME UNIVERSITY

Malmö, Sweden

MULTIMODAL TRANSPORT IN VIETNAM IN RELATIONSHIP WITH ASEAN COUNTRIES

A CASE STUDY OF ROUTES THAILAND – CAMBODIA – VIETNAM

AND LAOS – SINGAPORE

By

BUI THI BICH LIEN

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In

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(SHIPPING MANAGEMENT)

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DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University

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(BUI Thi Bich Lien)

24, October, 2011

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Supervised by:

Professor Patrick Donner

Associate Academic Dean – World Maritime University

Assessor:

Professor Daniel Seong-Hyeok Moon

World Maritime University

Co-assessor:

Professor Gerhardt Muller

US Merchant Marine Academy, Kings Point, U.S.A

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ABSTRACT

Title of Dissertation: Multimodal transport in Vietnam in the relationship with ASEAN countries.

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Each country has its own resources, which that country can take advantage of to create its own strategy. The conditions to develop multimodal transport are one of the factors to develop the economy. There are some countries that have many chances to develop door-to-door services with modern port systems as well as infrastructure, but there are some land-locked countries which have difficulty to exporting and importing cargoes to and from other countries. This leads to a requirement for transit cargo in a third country and creates the demand to combine many modes of transport to save time and cost as well as take the advantages of their own country.

The objective of this research is to analyze the strong points and drawbacks of Vietnam in developing multimodal transport with neighboring countries in the ASEAN region. Besides the cooperation, the competition among ASEAN countries is also emphasized.

The main objective of this research is to find the best combination of modes to transport cargoes within the ASEAN region, especially transport to and from Vietnam and the possibility that Vietnam can be chosen as a hub port for the ASEAN region in the future.

The research is based on the minimum of total costs, total transit time and total transit time variability principle to find the best link between the countries. The research took two routes Laos – Singapore and Thailand – Cambodia – Vietnam as examples by using

suitable methods to find the best solution for shippers and multimodal transport operators when choosing suitable means of transport to ship cargoes from their origins to their destinations.

The concluding chapter examines the results of the zero-one goal program, and gives some suggestions about potential routes in the future.

Keywords: multimodal transport, Vietnam, cooperation, ASEAN countries, model.

TABLE OF CONTENTS

Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AEC	Asian Economic Community
AFAS	Asian Framework Agreement of Service
AFTA	Asian Free Trade Area
AHP	Analytic Hierarchy Process
AHP-ITP	Analytic Hierarchy Process – Integer Linear Program
AHP-LP	Analytic Hierarchy Process – Linear Program
AHP-GP	Analytic Hierarchy Process – Goal Program
AHP-MILP	Analytic Hierarchy Process – Mixed Integer Linear Program
AHP-PGP	Analytic Hierarchy Process – Pre-emptive Goal Program
AIMO	ASEAN Integration Monitoring Office
ASEAN	The Association of Southeast Asian Nations
ATAP	ASEAN Transport Action Plan
ATM	ASEAN Transport Minister
B/L	Bill of Lading
BOT	Biuld – Operate – Transfer
BT	Build – Transfer
BTO	Build- Transfer – Operate
CAAV	Civil Aviation Administration of Vietnam
CEPT	Common Effective Preferential Tariff
COTAC	Cooperation in Transport and Communication
DWT	Dead weight tonnage

EDI	Electronic Data Interchange
EDIFAC	Electronic Data Interchange for Administration, Commerce and Transport
ESCAP	Economic and Social Commission for Asia and the Pacific
GDP	Gross Domestic Product
HCMC	Ho Chi Minh City
ICD	Inland Clearance Depot
IFC	International Finance Corporation
ISO	International Standard Organization
IT	Information Technology
KART	Kerry Asia Road Transport
MAUT	Multi-attribute utility theory
MCDM	Multiple criteria decision making
MICT	Manila International Container Terminal
MIS	Management Information System
MOT	Ministry of Transport
MPI	Ministry of Planning
MTO	Multimodal Transport Operator
ODA	Official Development Bank
PPP	Public Private Partnership
PTP	Port of Tanjung Pelapas
SIDA	Swedish International Development Agency
SKRL	Singapore – Kunming Rail Link
SOE	State Owned Enterprise
SP	Stated Preference
SSS	Single Stop Service

STOM	Senior Transport Officials Meeting
SWS	Single Window Service
TACA	Trans Atlantic Conference Agreement
TEUs	Twenty Feet Equivalent Unit
THC	Terminal Handling Charge
TIR	Transport International Routier
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America
VICONSHIP	Vietnam Container Shipping Line
VINAMARINE	Vietnam Maritime Administration
VOSA	Vietnam Ocean Shipping Agency
VR	Vietnam Railway Corporation
VRA	Vietnam Railway Authority
WMU	World Maritime University
WTO	World Trade Organization
ZOGP	Zero-one Goal Progam

CHAPTER 1: INTRODUCTION

1.1 Background

Containerization was born in the 1950s and has grown consistently since then leading to the modern concept of multimodal transport that includes the cargo delivery systems "port to port", "Container Yard to Container Yard" and "door to door".

Containerization was born as a prerequisite for multimodal transport to develop. Multimodal Transport can be viewed as "the chain that interconnects different links or modes of transport - air, sea, and land into one complete process that ensures an efficient and cost-effective door-to-door movement of goods under the responsibility of a single transport operator, known as a Multimodal Transport Operator (MTO) and on one transport document". (Al-Muhaisen, 2005)

At first, multimodal transport developed in Western Europe, America and Canada and Asia after that. In the 1960s and 1970s multimodal transport did not have any chance to develop because of limitations in technological conditions, organization and especially in regulation among countries and regions. However, in the 1980s when the United Nations Convention on the International Multimodal Transport of Goods was adopted, there were more and more actors joining in: national Multimodal Transport Operators, train stations, port authorities, institutes and insurance companies. From that time, there were many conferences and workshops about the development of multimodal transport.

In recent years, Asia has had many chances to promote multimodal transport, for example in the export and import of containers among countries. The trade between Asia

and Europe and North of America is the major premise to the development of demand in multimodal transport. Asian countries are intensifying building infrastructure serving multimodal transport such as: TransAsian railway line creating a combined sea – rail transport system to transport cargo intra-Asia and between Asia and Europe.

In 2010, the number of containers transported is estimated to has been more than 150 million TEUs compared to only 29 million TEUs in 1990.

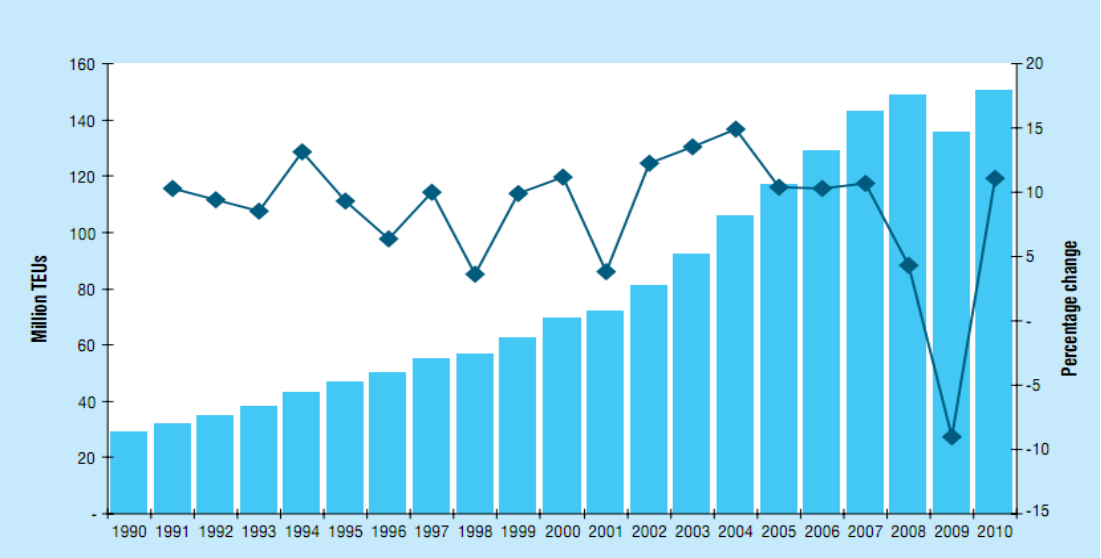


Figure 1.1: Number of container transported in the world from 1990 to 2010

Source: Drewry Shipping Consultants, *Container Market Review and Forecast 2006/07 and 2008/09*; and Clarkson Research Services, Container Intelligence Monthly, September 2010.

Multimodal transport is more and more popular with the support from the development of technology leading to competition among companies and among countries in general, forcing multimodal transport companies to use some useful tools to create their own comparative advantage, such as outsourcing, benchmarking and quality management.

The ultimate goal is to “deliver greater value to customers or create compatible value at a lower cost, or do both” (Al-Muhaisen, 2005).

Nowadays, multimodal transport forms are variable:

- Sea/air between Far-East and Europe, Europe and North America.
- Road/air: trucks are used at the beginning and the end of the process mainly for consolidation and gathering cargo at airports and after that cargo will be transported over a long distance trans-Pacific and trans-Atlantic or intercontinental.
- Rail/road: this form is used commonly in America and Europe because of its flexibility, safety and speedy.
- Rail/road/inland water way/ sea.
- Land bridges: the land route is supposed to be the bridge to connect two oceans with the purpose of reducing cost and time.
- Mini-bridge: usually used on the routes between America and Far-East, America – Europe, America – Australia. In this form, a through Bill of Lading is used from the port of loading to port of discharging, after that cargoes are shifted into train wagons and carried to another port in the same country.
- Micro bridge: the same as mini-bridge form, but the difference is that the destination is industrial centres.
- Piggy-back: is the combination of road and rail, where containers are transported by rail from one terminal to another and when coming to the destination they are placed on trailers and transported by roads.
- Sea-rail: is the innovation in multimodal transport, where containers are placed in the wagons and rail systems are connected with each other through sea transport.

1.2 Objectives

The objectives of this dissertation are:

- To analyze the strong points and drawbacks of multimodal transport in Vietnam and the ability to cooperate with other countries in ASEAN region.
- To review the methods used for solving multimodal transport problems in choosing suitable modes to minimize cost and time.
- To apply one of these methods to some cases with specific figures, solve problems and give a conclusion.
- To give some suggestions to improve multimodal transport in Vietnam and other ASEAN countries.

1.3 Methodology

The author has used various methods in this research and conducted it in four steps:

Step 1: By acquiring knowledge and collecting information – in order to identify the topic, useful knowledge from books, lectures, articles and field trips have provided a basic overview of transport in general and through presentations, seminars and discussion with professors and friends, the author has had a tendency to focus on the topic related to multimodal transport.

Step 2: By making a literature review – there are many methods in solving multimodal transport choice of modes. The author has used some of these methods as a tool to find a suitable way to transport cargo at the minimum cost and while spending the least time. This step expresses the understanding of the author about the topic selected.

Step 3: Using questionnaires and applying a model – at first, zero – one goal program modeling was chosen to find the best way to transport cargoes in two cases. After that, questionnaires were collected from logistics providers, forwarders, shipping lines and shippers to decide which factors affect the choice of modes of shippers or multimodal

transport operators. When there were sufficient factors gathered, an analytic hierarchy process was applied to calculate the weight of each factor.

Step 4: Using solver program in Microsoft Excel to get the result – data was collected based on many sources and previous research. The result coming out was used for supporting to the model that was selected. From this result, the author could analyze why Vietnam had not been chosen as a transshipment port for some countries in the ASEAN region.

1.4 Structure of research

The study is divided into 6 chapters as follow:

Chapter 1: *Introduction* – this chapter gives an overview and objectives of the research, besides, the structure and methodology applied for this research are also mentioned.

Chapter 2: *Literature review* – this chapter focuses on previous research of other authors involving in multimodal transport developing countries and models applied to choose modes in transport cargoes from origins to destinations.

Chapter 3: *Multimodal transport system in Vietnam* – this chapter analyzes the strong points and drawbacks of multimodal transport in Vietnam (infrastructure, legal basis, and so on). After that the author judges the opportunity for the development of multimodal transport as well as a hub port in Vietnam in the future.

Chapter 4: *Multimodal transport system in ASEAN* – the cooperation in multimodal transport of ASEAN countries is mentioned in this chapter, how the legal framework on multimodal transport affects ASEAN countries. The competition among ASEAN countries in terms of multimodal transport is also given.

Chapter 5: *The relationship of the multimodal transport system of Vietnam with the multimodal transport system of ASEAN countries. Case studies of Laos and Thailand-Cambodia-Vietnam route* – this chapter uses actual figures as the input for applying a model to solve the problem of multimodal transport in choosing modes. Based on the results the author analyzes the strong points as well as the weak points of each route that is chosen and is not chosen. Moreover, the author analyzes the opportunities for other routes in the future.

Chapter 6: *Conclusion* – the complete work is summarized in this chapter. Although it still has many limitations, the author suggests some possible trends to research in the future to improve and develop this topic more.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The important changes in the world liner shipping began 50 years ago when container vessels replaced the conventional liner vessels. The intermodal transport system was set up depending on the transportation of containers from door to door. (ISL, 1991)

Containerization covered both inland and ocean transport and the advantages of containers are reducing of handling time and the convenience for development of intermodal and transmodal operations.

Multimodal transport was born as a prerequisite for the development of logistics service. It also means that shippers or logistics providers want to find suitable modes to transport cargoes to save costs, but still assure the quality of the service provided.

Multimodal transport is defined as a system in which only one Multimodal Transport Operator (MTO) is responsible for transport activities. In a research of D'Este (1996), he gave a theory with five components of multimodal transport that the MTO managed and co-ordinated in door to door services. (D'Este, 1996)

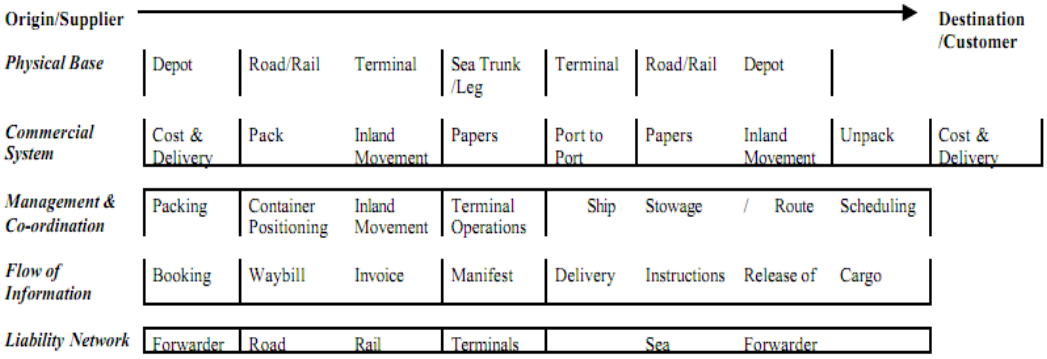


Figure 2.1: Five components of multimodal transport

Source: An event-based approach to modeling intermodal freight systems, D'Este (1996)

In Europe, multimodal transport has developed for a long time. It began with traditional multimodal transport service, including inland transport to the port, cargo handling at both ends, sea transport and inland transport at destination. Then, multimodal transport developed in Europe when a liner shipping conference was set up named the Trans Atlantic Conference Agreement (TACA) which introduced a new definition about "multimodal transport hub and spoke system". This new model was based on the rail transfer for inland transport instead of road transport. In addition, the research of Rawindaran VNP Nair, Bernard M Gardner & Ruth Banomyong, mentioned that TACA believed the collective price fixing for the trunk leg of multimodal transport service brings benefit, not only to the trade but also to customers. The development of multimodal transport in Europe could be reached when members of TACA verified with the European Commission and followed the European competition rules. (Rawindaran VNP. Nair, Bernard M Gardner & Ruth Banomyong, 2011)

2.2 Model applied to solve multimodal transport mode choice problem

Multimodal mode choice depends on many factors and many studies have mentioned those factors in different view. In order to solve this problem, there are three steps and many models can be used in each step. The first step is finding the main factors affecting the shippers', forwarders', multimodal transport operator's or logistics supplier's decision.

Each country has its own infrastructure and conditions to develop multimodal transport in different ways. Questionnaires are a good method to collect different ideas about this. The second step is making a decision on which factor will be the main factor and to identify the weight for each. AHP (Analytic Hierarchy Process) is the most used choice for factor analysis. The last step is choosing a route with different modes. There are many methods used by many authors, and in this dissertation the zero-one goal program modeling was used to choose suitable routes for cargo.

2.2.1 Deciding main factors influencing the mode choice determination of suppliers and shippers

Weighing the main factors based on AHP (Analytic Hierarchy Process):

In 1980, Saaty developed the AHP model to apply for multiple criteria decision making (MCDM). The application of AHP is more and more popular, and it is also easy to integrate with other models to quantify and qualify factors. There are about 35 articles integrating AHP with mathematical techniques, for example: AHP – LP (Linear program), AHP – ILP (Integer Linear Program), AHP – MILP (Mixed integer linear program) and AHP – GP (Goal Program). (Ho, 2007)

The study of carrier selection was researched a long time ago. McGinnis (1977, 1978 and 1979) and other authors in the early years gave the criteria based on countable things like costs and time. However, the uncountable things like security of product, relationship or reputation of carriers are not mentioned much. And these researches from this period did not weight the salience of each criterion.

Ms Brook (1990) had conducted a study on "Ocean carrier selection criteria in a new environment". In this research she mentioned the selection criteria, which are important to shippers and also the performances that carriers compared on those criteria using the Analytic Hierarchy Process. Each shipper was required to evaluate the performance of each of the carrier alternatives available and weight each criteria factor. In this study, Ms Brook confirmed the importance of "salient criteria" to develop strategies to attract and meet the requirement of global market, for example: cost of services, frequency of sailings, transit time, on-time pick-up and delivery and so on.

Liberatore, Matthew J, Miller, Tan (1995) had a research on "A decision support approach for transport carrier and mode selection" saying that there are many methods related to multi-criteria choice for example: multi-attribute utility theory (MAUT), scoring models, goal programming and AHP. The authors also gave the advantages and disadvantages of each method. It was said that goal programming was used most popularly in spite of this method being limited to the scalable criteria and with factors that can be quantitative such as average transit time or late transshipment.

Saaty had given the "eigenvector method" to calculate the weights of each factor based on a pairwise comparison matrix. Bagchi (1989) illustrated Saaty's method to solve the carrier selection problem in which he gave an example to evaluate criteria as follows: rates, customer service, claims handling, equipment available for flexible schedules and financial stability. After that there were some more authors applying the AHP method

like Banai (2000) and Dantas et al. (2001) to connect with a geographic information system in transit oriented development and find out the suitable location for a terminal.

In 2008 Meethom and Kengpol are the two authors who had a study finding out the weight of criteria for Thailand Quality Award based on AHP, Weiss and Rao used the tool for designing for large scale systems, Wang et al. with pairwise comparison of artificial neutral networks or Zahedi with the decision support systems

In a research of Cullinane and Toy (1999) about identifying influential attributes in freight route/mode choice decision in which they applied the Stated Perference (SP) technique in freight route/mode choice to find out which factors affect the decisions. Besides, this study also used systematic, quantitative analysis by simple methodology, such as question and hypotheses, sample analysis, category construction, system of enumeration and units of analysis to set up the most important factors influencing the mode choice decision. The result that they got from those above methods includes the five ranked category: cost, speed, transit time reliability, characteristics of the goods and service. (Kevin Cullinane and Neal Toy, 1999)

Tuna (1999) on the other hand measured the expectations of shippers, freight forwarders and logistics providers who are the customers of Izmir Port. He found that shippers really want to have accurate B/L production, safe and without damaged cargoes. (Okan Tuna and Mustafa Silan, 1999)

2.2.2 Model used to solve multimodal transport choice

In 1955, the Goal Programming was used firstly by Charnes, Cooper and Fergusion, they explained it as a technique that helps people to find the optimal goal but require the ordinal and cardinal information for multiple objective decision-making.

In choosing routes for multimodal transport modes, there are a lot of surveys using different methods to find the most suitable way to transport cargo from the origin to

destination. Banomyong (2001), Bookbinder et al. (1998), Min (1991) and Chang (2008) had some researches on quantitative criteria with the purpose of minimizing cost as well as time.

Athakorn Kengpol, Sopida Tuamee and Markku Tuominen (2004) had a study named "Design of a decision support system on selection of multimodal transportation with environmental consideration between Thailand and Vietnam", which also has a goal of minimizing cost and time, but related to minimum risk and limiting the effect on environment.

Jing and Wang (2004) measured and quantified the transportations' reliability, infrastructure and degree of public participation. They also gave the goals for transportation: mobility, accessibility, safety, environmental and public involvement. (Mingzhou Jin and Haiyuan Wang , 2004). Capelle (1994) showed the potential goals and performance indicators in his research including mobility, finance, environment, economics, safety and others. (Capelle, 1994)

The framework of a transportation system and problem of Mr. Paul Battaglia had given a summary that used four components: the objective, the decision variables, the constraints and the parameters. He stated that the goal is not only the minimum cost but also multiple goals and this model gave the chance to know the various connections between technology and integration at multiple levels. (Battaglia, 2007)

In terms of decision variables, many authors gave their ideas about them, for example Bragdon and Berkowitz (1999) who emphasized that a transport system which operated effectively and efficiently is contributing to the standard of life, makes people and society healthier, more economical and more secured. Boardman (2005) applied the method using least cost paths such as traditional costs and transfer costs.

In a research of Mr. Chang (2007) about "Best routes selection in international intermodal networks", he mentioned three main characteristics of problems: shippers have different targets so the goals should be multiple objectives, existing mode schedules and delivery times have to be included in the model as constraints and total weight transported by different modes are not the same, so the author suggested that the calculation of cost in related to economy of scale. (Chang, 2007)

However, another research of Barnhart and Ratliff (1993) had a study on finding the good route with low cost when cargoes were transported in trailers. Both of them used the method to research without depending on the three main characteristics that Chang mentioned.

The research of Mr. Min (1991) based on a chance-constrained goal programming model in which he identified four main key factors of international intermodalism: cost factors, service factors, risk factors and international factors. These factors affected directly on modal choice, selection of port and foreign trade. The purpose of this research was applying the model which is cost-minimization, delay of shipment minimization, in-transit inventory minimization and Just-in-time requirement satisfaction. He concluded that the mode's speed affected the choice of mode rather than the rate of freight or the variable delivery time and he also improved that the priority of goals had much greater effect on the choice of mode than the change of the para-metric factors – cost, time and variability. (MIN, 1990)

Zero-one Goal Programming (ZOGP)

Goal programming was discovered by Charnes et al. in 1955 and it was developed in 1960's by Ijiri. After that the book about Goal programming was applied in many aspects, especially for making a plan such as in agriculture or accounting. (M. Tamiz, D.F.Jones and El-Darzi, 1995)

As Srinivasan and Thompson studied in their research involved in choosing a best mode that met the requirements of minimizing the cost and minimizing the transport time. There was a method using the operator theory of parametric programming that was suggested in this research to find the optimal routes as well as optimal modes of transportation. (Srinivasan, V. & Thompson, G.L., 1977)

In a research of Selcuk Percin, he integrated the analytic hierarchy process and multi-objective goal programming to solve the problem and select the best carriers with minimum defects rate, minimum late delivery, minimum cost and suppliers' scores and after – sales service levels. He confirmed that the integrated AHP-PGP (Analytic Hierarchy Process – Pre-emptive Goal Programming) model is very necessary for enterprises to select suppliers. (Percin, 2006)

In research of Kengpol, Meethom and Tuominen about the support system in multimodal transportation routes in the Mekong sub-region countries, the authors used the AHP method to weigh three factors cost, time and risk, combined with the ZOGP method to find the optimal transportation cost, routing time and risk of route. This method had an advantage, which is that the optimal multimodal transportation route and needed significant weight can be given by users as they want. (Athakorn Kengpol, Warapij Meethom, Markku Tuominen, 2011)

Recently, Ms Yang (2009) had a Masters research titled "Intermodal Transportation in Major Asian Ports" applying the mixed integer linear programming and solver 2007 software to solve the problem of choosing modes to transport cargoes from China to India. The goal of the research's model is reducing cost, transport time and transport time reliability. The significance of this research was the quantitative analysis of the competitiveness of routes as well as suggesting improvements for people who do business in this aspect. She mentioned in her research that she found the optimal choice

for carriers, shippers and improved the constraint for government and policy makers also. (Xuejing, 2009)

In another research of Bookbinder and Fox (1998) with the aim of optimizing routings for intermodal transport containers from Canada to Mexico, they analyzed the comparative advantage of each route between five origins in Canada and three destinations in Mexico based on cost and transport time. After that they evaluated the competitive route options taking the inventory cost, total cost and analyzing the competitiveness of trucking in order to suggest the potential of expanding intermodal services. (James H. Bookbinder and Neil S. Fox, 1998)

CHAPTER 3: MULTIMODAL TRANSPORT SYSTEM IN VIETNAM

The development of trade not only within the country but also between countries all over the world has led to door to door services becoming more and more popular. Multimodal transport is one of the most significant tools to help multimodal transport operators provide door to door service.

While multimodal transport in the world developed from the 1950s with the establishment of containerization. In Vietnam, multimodal transport is still in the first stage because the government has not invested enough money to improve the infrastructure serving for multimodal transport and enterprises are not good enough to take a risk with multimodal transport service.

Therefore, in this chapter the author wants to introduce the multimodal transport system in Vietnam and give some comments about the advantages and disadvantages for the future development of this system.

3.1 Introducing the Vietnamese multimodal transport system

3.1.1 Legal documents and legislation concerning multimodal transport in Vietnam

In order to develop any business, the legal basis is very important. It requires government to identify the condition of each country to establish a legal system that is suitable with the country's real situation. If the legal system is good, enterprises will have a chance to have a fairer and healthier competition.

The legal basis in Vietnam on multimodal transport firstly introduced was the decree 125/2003 ND-CP about multimodal transport, and circular 10/2004/TT-BGTVT for introduction of the above decree.

In addition, Vietnam has issued circular 125/2004/TT-BTC introducing customs procedures for international multimodal transport and a condition about multimodal transport contracts in clause 119 of the Vietnamese Maritime Code. All aspects involving sea, inland waterways, rail, road and air are regulated by Codes such as the Vietnamese Maritime Code, Road Transport Law, Inland Waterway Law, Rail Transport Law and Civil Aviation Law.

However of the above laws, the Vietnamese Maritime Code is the only one mentioning "international multimodal transport", but the main content of this Code only prescribes the relationship and liability limitation of multimodal operators and shippers.

Furthermore, decree number 125/2003/ND-CP expresses the open minded policy and integration between countries: both Vietnamese and foreigners can join in multimodal transport business.

In terms of finance, foreign services providers must have professional liability insurance in multimodal transport or a bank guarantee to cover the liability of the multimodal transport entrepreneur for loss and damage, slow delivery and other risks, having minimum assets of 80.000 SDR or an equivalent guarantee.

However, this decree still has some shortcomings and inadequacies, especially the procedure to apply for a "multimodal transport license" (for Vietnamese enterprises) and "investment license in multimodal transport aspect" (for foreign enterprises). There are many opinions agreeing that this decree has discriminatory treatment and is not compatible with "foreign investment law" in Vietnam because the ASEAN countries signed the framework on multimodal transport within ASEAN, and other countries have

signed bilateral agreements with Vietnam regarding multimodal transport and for providing multimodal transport services in Vietnam. They just need to show a "multimodal transport business registration certificate" issued in accordance with the country's jurisdiction and the legal representative in Vietnam, which is the transport enterprise or Vietnamese transport agent.

Circular number 10/2004/TT-BGTVT prescribes that 100% foreign equity and joint venture companies are allowed to provide multimodal transport services. Therefore Vietnamese law has not yet allowed branches and representative offices to provide multimodal transport services.

In addition, there is Circular number 08/2004/TTLT-BTM-BTC-BGTVT issued by three ministries, Commerce, Finance and Transport, guiding container transshipment service implementation at Vietnamese ports. This circular is suited to market demand and meets the expectations of enterprises who want to deliver multimodal transport services. The circular applies to ports, organizations and individuals. Any enterprise, organization or individual with sufficient conditions are allowed to register to do business involving container transshipment at ports without asking permission.

3.1.2 Introducing Vietnamese multimodal transport operation enterprises

Vietnamese enterprises only registered their business according to decree number 10/2001/ND-CP (19-March-2000) of the Government concerning marine services businesses, including agencies, brokering, provisioning, tallying, towage, repairing, cleaning and handling cargo. These types of services employ about sixty seven thousand people on an annual basis.

But during this period, only two enterprises registered for multimodal transport services, eleven enterprises registered for logistics services and four enterprises implemented container transshipment at ports such as Ben Nghe, Hai Phong, Sai Gon and New port.

In general, the multimodal transport system in Vietnam at this time was very poor and showed many drawbacks, for example under-quality infrastructure, there was no legal basis concerning multimodal transport, enterprises were not confident to serve multimodal transport services.

After decree number 125/2003/ND-CP entered into force, container transshipment services were regulated by circular number 08/LB TC-TM-GTVT, dated December 17th, 2003 of the Ministry of Commerce, Ministry of Finance and Ministry of Transport and were guided on how to transit containers at Vietnamese ports. Only four state enterprises participated in this business.

This was the first period of establishing and developing container transshipment services at ports. There were many shipping lines demanding this service, but the demand was not met at that time, because they were unable to supply this service before this circular was established.

Being aware of that problem, multimodal transport service was regulated by the Government Decree number 125/2003/ND-CP, dated October 29th, 2003. In practice, this business was not provided by many enterprises. The slow development of these types of business was partly due to the shortage of future vision, and partly because they had not adapted to the requirements of market economy concerning container transshipment services and multimodal transport. On the other hand, since the government had not completed a uniform legal framework of special legislation related to transport, it was very difficult for enterprises to provide these services.

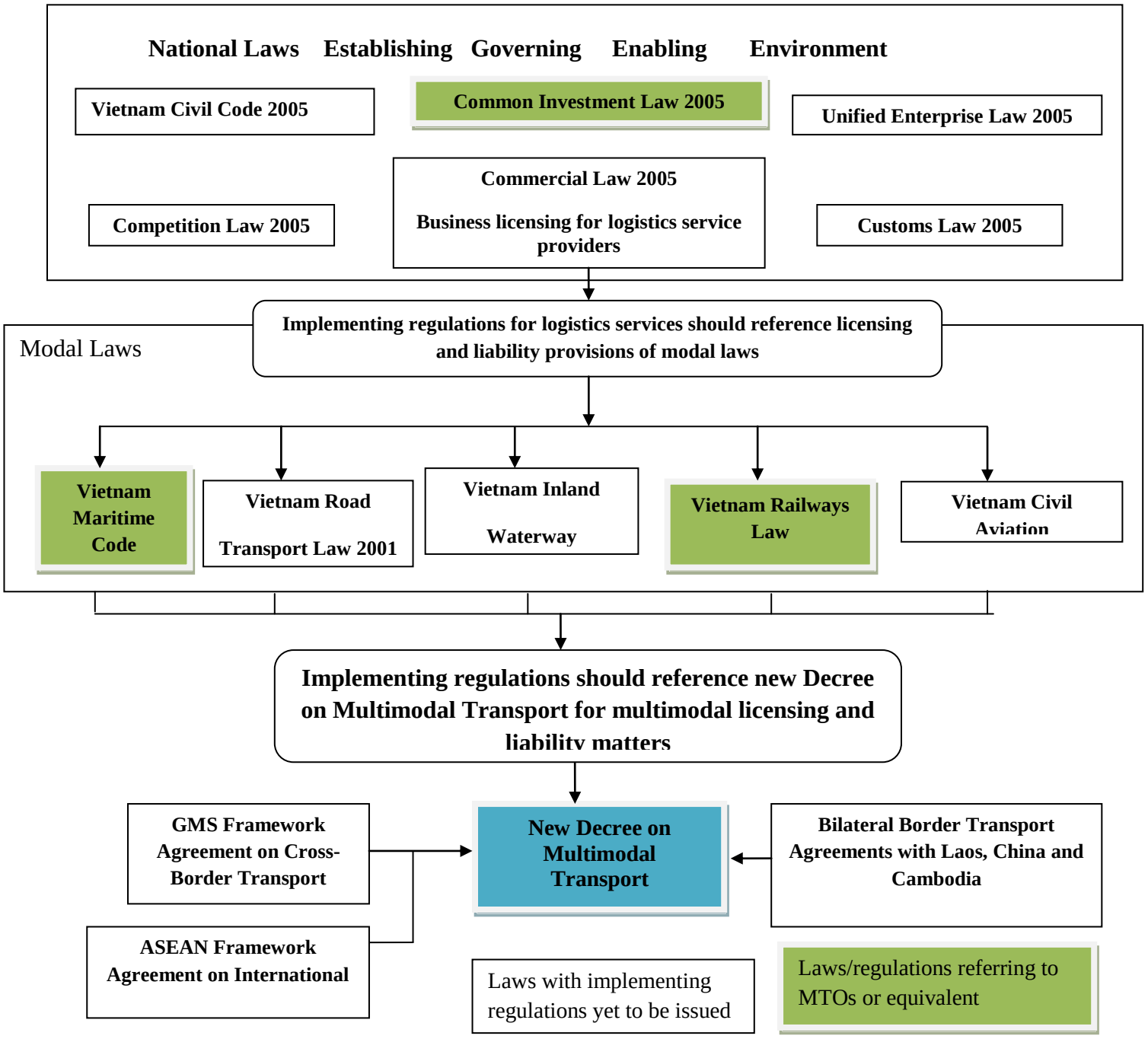


Figure 3.1: Proposed regulatory Framework for multimodal transport

Source: *Vietnam multimodal transport regulatory review*, 2006

The figure above shows the combination of many different Codes involved in transport such as Maritime Code, Road Transport Law, Inland Waterway, Railways and Civil Aviation law as references to implement regulations on Multimodal transport. It is complicated to connect these laws with each other, and it needs to sub-sector law be improved to be suitable with multimodal transport and enhance the role and responsibility of involved person needs to be enhanced effectively to implement multimodal transport in general and each link of door to door service in particular.

3.2 Multimodal transport infrastructure and multimodal transport operation situation of Vietnamese enterprises

3.2.1 The real situation of transport infrastructure (each modes of transport: road, rail, sea, inland water way and air) in Vietnam as a link of multimodal transport

Road transport it is said that road transport is the flexible mode of transport because loading and unloading is possible at any destination. However, in Vietnam the infrastructure for road transport is poor. Although the government has made an effort to improve the quality and capacity of the road system, the cost of using road increases remarkably due to delays and changes in delivery schedules happening frequently. There is a lack of high quality services and a lack of connection between policy and implementation. The Government has to enforce some other restrictions on speed and operating time, for example a container truck cannot enter into Ho Chi Minh City from 6a.m. to 21p.m. according to decision number 121/2007/QĐ-UBND dated Dec 19th, 2007 of Ho Chi Minh city's People committee.

Moreover, Vietnam has a total road network of 223,290 km; about 17,300 km are national roads and about one quarter of the whole network has two lanes or more. After the Project Management Unit eighteen scandal in which the Projects Management Committee had misused USD 1.8 million, sponsored by the World Bank, Japan and

some European countries to develop the transport network in Vietnam, by betting on football matches, the Vietnam Express Corporation was established with the purpose of developing the transnational connection and multimodal transport financed by three alternatives: 100% finance from the Government, local Build – Operate – Transfer and foreign Public Private Partnership arrangements.

Besides the problem of PMU 18, the Government has taken many experiences and tried to do their job better to recover what happened in 2006. Therefore, in 2010 the $400 million project of the 56km Cau Gie – Ninh Binh expressway was implemented. The Noi Bai – Lao Cai highway mostly depends on Asian Development Bank (ADB) loans and the Ho Chi Minh – Long Thanh – Dau Giay expressway project was supported by loans from ODA (*Official Development Assistance)* and ADB. (Phước Hà, 2007)

The Ministry of Planning and Investment (MPI) and the Ministry of Transport (MOT) will take the responsibility for national roads, investment finance, and implementation of these national road network projects, while the Vietnam Roads Authority (VRA) will undertake maintenance. Road traffic is focused on national roads, especially between and around the major urban centres. Traffic jams and the density of motorbikes are challenges to road transport and planners as well as policy-makers. Besides, serious accidents have increased significantly in recent years.

Inland waterway transport is a low cost service. For some shippers who have low value and less time-sensitive cargoes, inland waterway is the suitable choice. The infrastructure seems to be improved in terms of handling facilities, frequent maintenance and more reliable navigational aids. Although inland waterway vessels have become more efficient and larger, the role of this type of transport is still limited and there is a lack of competitiveness compared to road transport. Vietnam has 41,900 km of rivers, about 8,000 km of which are inland waterway navigable.

However, only 6,200 km are managed by the central government, the remainder being managed by local government. Inland waterways mainly transport cargo and earn freight. There are two large natural rivers in the North: the Red and Thai Binh rivers play an important role in the inland waterway network. In the South, the density of rivers is very dense. There are some main routes: Ho Chi Minh – Can Tho, which runs on the Nha Be river and Soai Rap river, and Ho Chi Minh – Phnom Penh.

On the other hand, there are still some bottlenecks in the development of inland waterways. They are poorly managed, lack data and information on facilities, conditions, navigational aids and port facilities. Besides, the services do not meet the requirements and passages are quite small and low draft. The vessels which are operating in the North of Vietnam have capacity from 100 to 400 tonnes. In the north, important transport services are managed by the State. While in the south private operators get the responsibility for managing the inland waterways. Because of the development of the private sector, the inland waterway has improved remarkably well.

Railways: The total length of the railway network in Vietnam is around 2600 km including seven main lines and several branch lines. The former Ministry of Transport was divided into a series of State Owned Enterprises (SOEs) covering three area companies, infrastructures for 20 enterprises and the repair and construction of other aspects involved in rail transport services. In 2003, the Railway Authority was established to take the responsibility for policy build up, regulation and safety matters. In addition, the Vietnam Railway Corp. (VR) was given the responsibility for the rail operations. The railways in Vietnam are not as efficient and effective as in other ASEAN countries. The railways were operated to connect residential areas to the centres of culture, agriculture and industry: Vietnam – China, Vietnam – Cambodia, Vietnam – Laos, Thailand, Malaysia and Singapore. In 2010, there were nearly 280 train stations with VR operating six main lines with 13.4 million passengers and 8.9 million tons of freight.

Nowadays, the Vietnam Railway has to come with some problems. It is developing very slowly in terms of speed improvement, investment capital amount and the role of rail transport is decreasing in both capacity and volume. The railways network can increase, however, as a result of recent changes in financing and policy by establishing a close relationship among commercial operators and the government. Besides, Vietnam should open for investors and multimodal transport operators who are interested in expanding multimodal transport services.

The other problem of railway transport is that the operators are not concerned about environmental aspects. They just want to get as much benefit as they can.

Maritime transport: There are many operators doing business in this aspect such as state-owned companies, local government-owned companies, joint ventures and private companies. The Dead Weight Tonnage (DWT) of Vietnamese cargo ships is over 1 million, of which 20% are domestic coastal shipping and the rest are engaged in ocean shipping. The average vessel size is about 8.000 DWT for ocean going ships. There are some Vietnamese shipping companies providing international services. Vietnamese seaports are connected with ASEAN hub ports, and a lot of feeder vessels operate on these routes. Ho Chi Minh City holds a market share of about 50% with 26 feeder container ships per week. Vietnamese shipping companies keep 21% of the total foreign trade. It is a relatively small figure, because Vietnamese fleets still have many drawbacks and suffer from strong competition from strong foreign fleets.

Domestic shipping mainly transports agricultural, mining and industrial products, but nowadays containers are becoming more and more important.

Air transport The Civil Aviation Administration of Vietnam (CAAV) manages civil aviation and government takes responsibility for indirect control. In Vietnam, the total number of *airports* is 135 civil, military and police airports used within the country, in 18 of which air navigation services are under the management of CAAV. The number of

passengers transported in 2010 was about 12 million. Noi Bai airport in Hanoi and Tan Son Nhat in Ho Chi Minh City are the two biggest airports in Vietnam. In terms of transporting cargo: the amount of cargo transported abroad from Vietnam was 340.000 tonnes and customers' demand was expected to increase in 2010. However, air transportation in Vietnam is still below international standards leading to a low share of the overall transportation market, so improving the infrastructure as well as the quality of service are very important.

Ports Some ports in central Vietnam are managed by the Vietnam Maritime Administration (VINAMARINE), but all ports are under the jurisdiction of the Ministry of Transport through the Vietnam National Maritime Bureau. Although State owned ports hold almost the entire market, there are some national shipping lines which operate in Haiphong, Saigon, Danang and Cantho, and other State owned enterprises of local governments and ministries other than the Ministry of Transport. The big disadvantages of *Vietnamese* ports are shallow water depth, poor infrastructure and poor cargo handling equipment, but Vietnamese ports are improving in both port efficiency and amount of cargo handled. Port efficiency depends very much on the conditions of ports and port fees nowadays can compete with other neighboring countries. The improvement in customs service procedures, reduction in paper work and investment in IT systems are contributing to the development in the port system of Vietnam, but congestion is a big problem hampering the connection of ports with the hinterland, leading to increase in operating costs. Besides, the ports of Singapore and Hong Kong are very strong because they have deep seawater. Vietnamese ports can't compete because the draft is not sufficient to be called by mother vessels. So, a big amount of cargoes require trans-shipment in bigger ports to come to other countries. The Ministry of Transport is trying to build a deep sea port in Cai Mep, which belongs to the fifth port cluster planning and hopefully this port can receive larger ships in the near future.

Logistics In Vietnam nowadays, there are more and more companies supplying logistics services and they are trying their best to reduce cost and providing the customers with reasonable freight. Multimodal transport contributes much for logistics activity, and it creates a *lot* of revenue for enterprises. In multimodal transport the connections between modes of transport are very important, but in Vietnam some constraints happen because of lacking guaranteed service schedules. For example, delivery times of shipments are not easy to follow, information systems are not good and fast enough, in addition to poor facilities of custom procedures leading to inefficient handling of cargoes.

3.2.2 The strengths and weaknesses of multimodal transport business of Vietnamese enterprises

Multimodal transport is applied popularly all over the world. Global commerce combines information technology in transporting containers leading to the emergence of multimodal transport. The requirements in trading globally are higher and higher, containers express their advantages in transport, cargo handling and easy to implement door to door service. Multimodal transport promotes new business to reduce storage time and cumbersome procedures, enhancing safety and security. Besides, multimodal transport assures that door to door services are faster and more effective with the cheapest price.

When Vietnam accepted foreign investors, economic integration in the region and internationally, this has brought both opportunities and challenges to Vietnam in terms of taking the advantages as a nation. Multimodal transport is considered as a strategy in implementing "industrialization – modernization" in Vietnam because development of the transportation network is one of the ways to do that for each country. In the 20^{th} century the world witnessed the development of sea, inland waterway and rail transport, but now air, road and pipe transport are growing more and more.

In contemporary days, Asia holds about 50% of the container volumes in the world and nine of the ten busiest ports in the world are in Asia (Olsen, 2010). In terms of shipping, according to UK Port and Logistics Ltd., 10 Asian container shipping lines belong to the top 20 global container shipping lines. The development of Asian transportation in general, and maritime aspect in particular, is an advantage to promote the development of Vietnamese transportation.

It is said that where there is trade, there is transport. In recent years Vietnam is growing with high speed, more and more commodities are produced and transport demand is increasing remarkably. The establishment of industrial zones will help transport services show their ability in connecting producers and customers. Total export turnover of Vietnam reached USD 71.7 billion in 2010, an increase of 25.5% compared to 2009, while the increase percentage in the value of export cargoes was 14.5%. Manufacturing industries have a tendency to increase. The proportion of the goods processing industry rose slightly from 63.7% to 67.9%. The total of import turnover in 2010 was USD 84 billions, rising 20% compared to 2009, but the value also rose by USD 14 billion.

3.2.2.1 The facilities for multimodal transport

Infrastructure in Vietnam is improving day by day. However, lack of capital investment leads to non-synchronization in transport networks causing difficulty in connecting modes of transport for moving passengers and cargoes. Nowadays, Vietnamese infrastructure is still poor and substandard, including a cumbersome legal system. The biggest problem, however, is capital: shipping, aviation, railways and roads need capital to develop as an urgent need nowadays. Ngo Thinh Duc – Deputy Minister of Transport said that in 2011, in order to prepare well for the plan of economic and social development and in the five years from 2011 to 2015, the Ministry of Transport will make an effort to increase cargo transport volume by at least 8-10% and passenger transport numbers by 9-10% in parallel with reducing accidents and congestion. Besides, the Ministry will try their best to build new and upgrade as well as renovate more than

800km of road, to construct about 10.000m land bridge, to renovate 40km railroad and build 36.000m^2 airport terminals and 600m of runway.

Caimep port of Vietnam is considered to have a potential to become a hub port in the ASEAN region because of the good geographic location and long sea shore. However, so as to become deep seaports to receive big vessels, the government needs a big amount of money to invest in infrastructure and dredging. In addition, the Government has to attract more international shipping lines and port operators. The other imperatives are reducing corruption and enhancing the transparency in policy.

However, as mentioned before the complex and restrictive legal environment and the long payback time caused the hesitation of private investors in investing in infrastructure development.

The combination of modes of transport in Vietnam, the importance of multimodal transport is well known, but with the small capital and lack of competent human resources, enterprises can only be agents, brokers, or other intermediaries. If they want to have a bigger role in trade, they have to connect with each other. Vinalines and VNR (Vietnam railways) can be taken as an example; they signed a cooperation agreement on 26th of October 2007 to invest in Inland Clearance Depots (ICD) in key economic zones of the country and to utilise the railway network to transport cargo to these ICDs. In addition, in order to connect sea transport and the railway network with Vinalines's ports in Cai Mep – Thi Vai, Hiep Phuoc, Van Phong, Ba Ngoi, Hai Phong, Dinh Vu and Cai Lan, both parties will combine to make decisions to invest in these railways.

Besides, developing Electronic Data Interchange (EDI) systems are also important nowadays, especially applying to implementing multimodal transport. In Vietnam, EDI is used effectively in Haiphong port, which constructed an EDI program according to the standard of Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT). This system combines container management data in a Management

Information System (MIS) to give reports in electronic form to carriers and shipping agents. The problems are that the awareness of Vietnamese enterprises about e-commerce standards is not high. Only about 45% of agencies and companies confirmed that they knew them. Even the number of experts knowing these standards is small, Government has supported enterprises in more training in e-commerce, but this has still been concentrated on business skills and not on competent human resources. Moreover, the legal system for EDI systems is not comprehensive enough, lacking of guidance for applying EDI systems in enterprises. And the last obstacle stems from enterprises' traditional transaction habits as they still see EDI as a new method and are not familiar with it.

3.2.2.2 Legal framework

In Vietnam, multimodal transport is regulated in articles 87 and 88 of the Vietnamese maritime Law in force from 01-Jan-91.

Article eighty seven states the definition about "combined transport". "Combined transport" is transport of cargoes by road, inland water way, or air. Although there is no law similar to international convention, it still started a period for developing multimodal transport in Vietnam. Article 87 also regulates the responsibility of carriers when signing a through Bill of Lading.

The law mentions different modes of transport joining in the period of transport, but it does not regulate clearly about contracts of carriage such as international conventions, both parties can negotiate and conduct following the international custom or foreign law.

The aviation law regulates the contract in articles fifty nine through article sixty four. Article 59 indicates that the carrier has to transport the cargoes agreed in the contract to the place of delivery to the consignee. An Airway bill is the receipt for cargo transported to destination and is proof of the signed contract. The law also regulates the civil responsibility of the carrier from article seventy two to article eighty one. The common

principle of aviation law allows applying international treaties that Vietnam is a party to. Besides that, enterprises can negotiate and sign transport contracts, provided they do not offend mandatory law and Vietnamese custom.

Clearly, maritime and aviation law do not meet the requirements of international trade, but they are the main legal basis for implementing multimodal transport in Vietnam nowadays. In terms of road transport, railway transport and inland waterway transport, the Ministry of Transport has issued the relevant documents and enterprises have to abide by these documents when doing multimodal transport business.

The establishment of the draft Government Decree on multimodal transport business will create a more detailed, more sufficient legal basis for multimodal transport services. This decree contains eight chapters.

3.2.2.3 Enterprises doing multimodal transport business in Vietnam

There are some well-established companies involved in transportation such as Vietfracht, Vietrans, Transimex, Gemadept, Vosa. However they only do some parts of the multimodal transport process for example, using multimodal transport documents or hire means of transport.

Vietfracht has provided combined transport for a long time, especially when foreigners invested in Vietnam and customer's demand increased. After the UN Convention on International multimodal Transport of Good was adopted in 1980, Vietfracht opened the first export routes from Ho Chi Minh to Paris in 1982, mainly transporting containers in 45 days from:

Ho Chi Minh – Black Sea route, where cargoes were transported by Lash of Interlighter. This was the first route applying multimodal transport in Vietnam. Because of the scope's limitation, Vietfracht could not find enough cargoes to transport. Besides, the freight rate was very high in the European routes.

Black Sea – Regensburg (Germany) route, where cargoes were transported by tugboats or barges and Regensburg – Paris, transporting cargo by train. The second route of Vietfracht applying multimodal transport was set up in 1988 transporting asphalt by sea from Singapore to Danang and by truck from Danang to Savanakhet

Vietfracht signed the combined transport contract from Singapore to Savanakhet for the shippers, the Swedish International Development Agency (SIDA) in Singapore. For the route from Singapore to Danang, some ships of Vosco and Donasco were used, but from Danang to Lao, Vietfracht hired trucks from the Quang Nam – Da Nang road transport and No. 6 road transport enterprises. However, this route was soon abolished because the relationship between Thailand and Laos was improved and Laos returned to transporting cargoes to Bangkok. It was a reasonable decision, because the route between Vietnam and Laos was not good enough, easy to be interrupted when it rained and the procedures and customs formalities were cumbersome.

In recent years, Vietfracht has done business on some routes by using multimodal transports network, but they focus on agent activities for container ships, bulk cargo, general cargo, reefer, roro, tanker and passenger ships for some well-known shipping lines. (Vietfracht, 2010)

Vietrans is another enterprise doing multimodal transport business. This company mainly transported by air, sea and truck. In the first period, Vietrans accepted to be agents for foreign shipping lines in forwarding cargoes in seaports and airports, and delivered cargoes to the final customers. In recent years, some shipping lines have allowed Vietrans to use their combined B/L in consolidating and transporting cargo to hub ports or other intermediate ports.

In the year 1982, Vietrans boldly operated the first multimodal transport route from Vietnam to Budapest, choosing Heychevsk as trans-shipment point and Zosuvnestrans as

through B/L for the cargo. Although the time for transport was very long, Vietrans was quite successful on this route.

After that, Vietrans signed a contract as agent for Dynamic Service belonging to the Jardine Matheson group in Singapore and Militzer Munch in Western Germany.

The strong points of Vietrans were the acumen with demands and expectations of foreigners and the application of information technology in multimodal transport. It means they know what their customers need and provide service immediately. They also had high quality staff, a large warehouse system in ports and hundreds of effective trucks. They act as agency for some foreign transport companies such as IBF in Hong Kong, Singapore, Bangkok and DFS Singapore. (Vietrans, 2011)

Vietnam Muti-modal Transport Company (Vietranstimex) In 1976, the company only acted as transport agent in Da Nang. In 2003, the Minister of MOT issued decision number 3097/QD-BGTVT changing the name of the company from Transport Service No. 2 to Multimodal Transport Company belonging to the Ministry of Transport and operating in a "Mother company – Subsidiary" mode. Most recently, in 2010, the company received the decision number 1454/QD-BGTVT about approving the plan to equitize from a "Mother – Subsidiary" company to a "Multimodal Joint Stock Corporation".

Nowadays, the company is operating in most regions of Vietnam with four subsidiary companies, one joint venture with foreigners and four other branches. The company has around 200 special axles type G7 vehicles utilized in transportation of oversize and overweight cargoes and more than 100 units of transport as well as stevedoring facilities of many kinds, enabling them to carry out many jobs at the same time with a whole dimension up to 3,000 tons in weight. The company is always a first company in investing in advanced technology combining it with high quality human resource. They want to become the top transport corporation in dimension/oversize cargoes in the

ASEAN region. Multimodal transport is the strategy of the company in expanding the operational aspects of the company.

Other companies including VOSA, VICONSHIP and GEMADEPT, are implementing multimodal transport on behalf of joint-venture shipping lines and foreign companies.

In Vietnam, enterprises clearly identified the importance of multimodal transport. However, they did not have enough capital and lacked human resources so in the past most enterprises did business as brokers, agents or other intermediaries.

Nowadays, these problems are considerably reduced and Vietnam is setting up multimodal transport in the same way as global companies. Specifically, two big transport companies – VINALINES and VNR signed a cooperation contract on 26 October, 2007. They are developing Inland Clearance Depots (ICDs) in some key economic zones in the north, in the centre and in the south by building railway networks to transport cargoes to these zones. In the first period, they joined in the project to invest in ICD Lao Cai. In addition, the railway network connects with the ports of Vinalines in Cai Mep – Thi Vai, Hiep Phuoc (HCMC), Van Phong (Khanh Hoa), Hai Phong (Lach Huyen), Dinh Vu (Hai Phong) and Cai Lan (Quang Ninh). Each project requires cooperation and detailed planning. In terms of multimodal transport, the two companies will develop the cooperation based on the strong points of each partner. Vinalines will focus on the big ocean ports and ICDs in key economic zones. However, other transport networks such as road, rail and inland waterway must be closely coordinated. VNR can take the advantages of the big amount of cargoes transported, low freight and follow the time in schedule. In the future the cooperation between Vinalines and VNR will be promoted effectively.

3.2.3 Comment on multimodal transport business in Vietnam

In legal aspect: Vietnam lacks a specific regulatory system on multimodal transport in the Vietnamese maritime code, road code, inland waterway code, rail code and aviation code. It is very difficult to identify the responsibility or to connect transportation types together in a multimodal transport service.

Infrastructure: Most transport networks, such as road, rail, inland waterway, maritime and air cannot meet the requirements for international multimodal transport demand. Information technology support for multimodal transport is deficient, despite being more and more improved.

Enterprises doing multimodal transport business: enterprises are not trained and do not have much knowledge about transport law, lack experience and find it difficult to compete with foreign enterprises joining in this type of service in Vietnam.

3.3 Development strategy for multimodal transport system in Vietnam according to port development planning and Sustainable Development of Transport System (VITRANSS2) of Prime Minister (Prime Minister, 2009)

3.3.1 The goals and trend to develop multimodal transport system in Vietnam from now to the year 2020

Multimodal transport brings great advantage and benefit for the economy. The Vietnamese government is trying its best to develop multimodal transport in the near future, in particular, they set forth a plan from now until 2020 and the vision for 2030. If Vietnam can implement this plan well, we will have modern infrastructure meeting the requirements of domestic transport in general and multimodal transport in particular.

Transportation is an important part of economic – social infrastructure. Investment in transportation should be one of the first priorities with high speed and sustainability. Transportation is a prerequisite for developing social, economic and military aspects and especially for support to the industrialization and modernization contents in Vietnam.

Vietnam should take advantage of the geographic location and natural resources of the country, such as the long coastline and inland waterways to develop transportation networks suitably leading to reduction social cost.

In order to take advantage of the geographical situation, government and other organizations should develop transport infrastructure in a synchronized way to set up a good, continuous network of transport modes between urban and suburban regions in national scope. Besides, the existing transport network must be maintained and operated efficiently and effectively.

On the other hand, Government must focus more on development of modern, high quality transport, suitable cost of transport, assuring safety, limiting environmental pollution and saving energy, applying information technology, especially multimodal transport and logistics.

In addition, connecting new investment and innovation, upgrading, taking advantages of the existing transport industry, modern technology, especially building vessels, automobiles and wagons used domestically and for export is also very important. It is necessary to develop a global transportation system in connection with the national transportation system to cooperate, integrate regionally and globally.

Another thing to do is developing fast, big capacity modes of transport, for example railway transport in big cities like Ha Noi and Ho Chi Minh. Developing transportation in the big cities by using public transport to assure safety and convenience is important. Besides, controlling the increase in personal transport, reducing traffic jams and assuring safe and order by traffic need to be done immediately.

Moreover, Government is trying to develop local transport to meet the requirements of industrialization and modernization in agriculture, connecting local transport with

national transport networks to create smooth and continuous flow of goods with suitable cost.

Another problem are resources, Government has to mobilize maximum resources, increasing domestic resources to invest in transportation. Government should set up tactics and strategies to attract more investment and take advantage of the country's available resources.

Last but not least, using land for transportation suitably, planning to use land for transport, which requires concensus, close connection and synchronizing implementation between ministries and local regions will create more conditions to develop multimodal transport in Vietnam.

3.3.2 Strategy in developing transportation in Vietnam

Transport networks must meet a variety of transportation demand with fast growth and assure high quality, suitable cost and reduce traffic accidents and limit pollution. In general, the transportation network needs to be set up with a suitable transport system between modes of transport, particularly for some commodities in large volumes.

Road transport: highways and roads must be improved and widened especially some highways having high transport demand, for example 1A highway, 13^{th} highway or Hanoi highway and so on. Besides, subways are also focused on and capital for new building and maintaining of subways also needs to be found.

Railway transport: innovation and upgrading existing railways to get the standard up to 120km/h. New high speed railways need to be built, particularly the North-South railway with the speed of 350km/h. Railway transport can be used for carrying cargoes as well as passengers as public transport, particularly in Hanoi and Ho Chi Minh City.

Maritime transport: develop the national ports system, including the Van Phong transshipment port, international gateway ports and deep sea ports in the three key

economic clusters that are able to receive the current generation of container ships, multipurpose ports, specialized ports, passenger ports to meet the economic – social development and international integration requirement. Investing in and developing port infrastructure, including berths, narrow passages, hinterland transport and other support systems.

Inland waterway: upgrade main inland waterway routes, innovate some important routes, increase length of river routes that are being operated. Upgrading and building hub ports, cargo berths and passenger berths, especially in the Red river and Cuu Long river are necessary.

Aviation: upgrade, enlarge and build new airports to international standard, invest in the international airports in Hanoi and Ho Chi Minh City, research and invest in some new airports with the same scale and quality as large airports in the region with operation capacity increasing 3 to 3.5 times in 2020.

Urban transport: developing urban transport infrastructure and public transport, increasing land used for urban transport from 16 to 26% in 2020. In some big cities public transport is promoted, elevated railway and metro system in Hanoi and HCMC to carry passengers to be increased from 35% to 45% in 2020.

Rural transport: the purpose of developing rural transport is to help motor vehicles transport to villages. Inland waterways are a big advantage of Vietnam and should be invested in more in the future to create the smooth flow of transport for the Mekong region, and Cuu Long river delta.

Railway and aviation industry: building new and modern, convenient and varied passenger wagons used domestically and for export, creating spare parts, components and assembling modern locomotives.

In terms of aviation the strategies are increasing the ability in repairing and maintaining air planes, aircraft engines and other equipments until 2020, broadening supporting services to foreign airlines, cooperating in making some air plane components and spare parts.

3.4 Suggesting methods to achieve those goals

3.4.1 Government has given some methods to support transportation

Firstly, encouraging all economic sectors to join in the transport business or supporting transport services. Establish transport groups having state's capital to support some routes that have big demand such as North – South, public passenger transport and transport supporting regional, remote areas and islands, even for other unexpected tasks when necessary.

Secondly, Government should support public transport and transport serving regions, remote areas and poor regions in many forms, for instance, preferential credits, incentives after sales facilities, investment or subsidies.

Thirdly, encouraging enterprises to use domestically assembled means to carry passengers in some forms such as deferred payment, instalment sale and incentive policies in importing spare parts and equipment that Vietnam has not produced yet.

Fourthly, setting up suitable freight and fee systems between modes of transport in which State plays a macro instrument role.

Lastly, developing a variety of forms of transport and transport support services in order to assure safety, high quality, speed and convenience and to save cost is also important. The Government especially emphasized that developing multimodal transport and logistics services in transport cargo is very important.

3.4.2 Creating more capital to develop transport infrastructure

First of all, maximizing mobilization of all resources, focusing on internal resources and creating conditions to attract more investment capital from economic sectors under many forms to build transportation infrastructure, especially investment in some forms such as Public Private Partnership, Build-Transfer-Operate, Build-Transfer and Build-Operate-Transfer should be noted. In addition, Vietnam is applying the form that the State will invest in building infrastructures and organizations or individuals will lease these infrastructures to operate and have capital for maintenance or investing in other constructions.

Second, setting up maintenance and investment funds to develop transport infrastructure where the first priority is a road maintenance fund. This fund will help rural transport develop.

Third, building modern urban infrastructure, focusing on public transport with big number of passengers and static transportation system to solve the traffic jam problem as well as limit pollution in big cities like Hanoi and Ho Chi Minh City.

Fourth, using suitable land for developing transport infrastructure, especially urban transport infrastructure, should be considered. Besides, combining public land, metro and elevated transport to use land effectively, and plan to redistribute urban space to create more land for development of urban transportation.

Fifth, planning and building transport from communes to districts to assure that rural transport develops in harmony and links with the national transport system. Besides, strengthening institutions and improving the institutional management of rural roads.

Finally, innovating means of transport in quality to be suitable with requirements in transporting cargoes and passengers is also a target to develop transportation. Strengthening management, periodically checking the quality of transport modes quality

and service quality, especially in passenger transport are also important. Moreover, developing organizations and associations to protect customer's interest should be noted carefully.

3.4.3 Developing transport industry policies

Encouraging transport enterprises to expand by forming joint-ventures, domestic and abroad, in order to mobilize more capital, information technology transfer and management experience exchange.

Besides, establishing financial leasing companies with State guarantees as a condition for enterprises to approach or use finance sources. Beside, technologies and new equipments should meet the requirements of customers.

3.4.4 International integration and competition policies

Develop external synchronization of the transport system and between modes of transport together with handling equipment with technological standard comparable with countries all over the world. Capital and resources are priorities to develop a modern fleet of ships and airplanes. Furthermore quality and service standard must be enhanced to assure international competitiveness.

Continue amendment of laws, institutions and policies that are suitable to WTO and other international coordination organizations, which Vietnam is a member of.

3.4.5 Organization innovation, administration reform policy

Government should rearrange organization following a functional model and divide the state management function of state owned companies between the production and business function of enterprises.

In addition, innovating administration in transportation by applying information technology and international standards issued by ISO and mobilizing transport plan management are suitable to actual requirements.

3.4.6 Applying new technology and science policy

First of all, building and improving the standards, procedures, regulations and rules in survey, design, construction, testing, maintenance, material and technologies used in transportation. After that Government should encourage enterprises to apply new technology and new materials.

Next, modernizing modes of transport, cargo handling and applying modern technology, especially in multimodal transport and logistics services, will create the chance for domestic enterprises to get more revenue and benefit. Enterprises should be always encouraged to apply information technology in management, control, and operation.

Finally, enhancing the ability of research institutes and experiment centers involved in transportation would help develop multimodal transport in the long term.

3.4.7 Resources development

The first step is broadening training, retraining, social training to enhance knowledge, management skills of managers, servants, officials and workers.

Another way is applying salary and other incentives for workers in transport employment conditions, especially in maintenance of transport infrastructure in regions, remote, dangerous and hard working areas.

Furthermore, focusing on enhancing the ability and equipment of training centres, especially supporting training for pilots, officers and seafarers to enhance qualified human resources is also a good choice. Afterward, mobilizing the coordination and connection between companies using human resources and training centres to meet the requirement of actual demand and to use trained human resources are necessary.

CHAPTER 4: ASEAN AND THE MULTIMODAL TRANSPORT SYSTEM OF ASEAN

4.1 Trading and transportation system of ASEAN

4.1.1 ASEAN trading

ASEAN was set up in 1967 with the purpose of promoting the development of economies, keeping peace and stability and strengthening the cooperation among members. Currently, there are ten countries in ASEAN but they are heterogeneous. In the ten countries, there are seven countries connected physically with each other and three countries (Indonesia, the Philippines and Brunei) are islands. Vietnam became the 7th member of ASEAN in 1995.

The differences in the economies of the member countries significantly hamper the development of ASEAN. For example, Singapore is 80 times richer than Myanmar, the population of Indonesia is 230 million compared to 4.7 million in Singapore and so on. These diversities have restrained the progress of organization for the 40 years since its establishment.

Figure 4.1: Map of countries in ASEAN

Source: Association of Southeast Asian Nations

Moreover, ASEAN is noted as a potential growth region in which members are cooperating in three main aspects: economic, political and security and social – cultural. There were several important events that lead to the establishment and development of this region as listed in table 4.1 below:

Year	*Event*
8-Aug-1967	Setting up the Association of Southeast Asian Nations (ASEAN)
27-Nov-1971	Signing the Zone of Peace, Freedom and Neutrality Declaration
24-Feb-1976	Signing the declaration of ASEAN Concord and the Treaty of Amity and Cooperation in Southeast Asea
28-Jan-1992	Signing the agreement on the Common Effective Preferential Tariff (CEPT) Scheme for the ASEAN FTA
15-Dec-1995	Signing the Treaty on the Southeast Asia Nuclear Weapon – Free Zone
15-Dec-1997	Adopting the "ASEAN Vision 2020" roadmap on the occasion of the 30th Anniversary of ASEAN
13-Jan-2007	Signing the Cebu Declaration on the Acceleration of the Establishment of an ASEAN community by 2015
1-Apr-2009	Adopting the Cha-am Hua Hin Declaration for the 2009 – 2015 roapmap for the ASEAN community
By 2015	ASEAN Economic Community to be fully implemented

Table 4.1: Important events of ASEAN

Source: World Economic Forum (2010). *Enabling Trade in Greater ASEAN region* Geneva: Margareta Drzeniek Hanouz and Thierry Geiger.

Each ASEAN country has its own language, own culture and the populations are also very different from each other. The table below shows the differences in number of people, GDP and share of export and import within the member States.

Countries	Population	GDP per capita (PPP) (USD/year)	Share of total ASEAN trade (2009)	
			Export %	Import %
Brunei	400,000	51,600	0.88	0.33
Myanmar	55,390,000	1,197	0.78	0.53
Cambodia	13,995,904	2,100	0.62	0.54
Laos	6,320,000	2,500	0.15	0.24
Indonesia	229,965,000	4,200	14.38	13.33
Malaysia	28,310,000	14,700	19.36	16.98
Philippines	91,983,000	3,500	4.73	6.27
Singapore	4,553,009	62,100	33.29	33.84
Thailand	62,713,941	8,700	18.82	18.42
Vietnam	87,375,000	3,100	6.99	9.53
ASEAN	581,005,854		100	

Table 4.2: Population, GDP per capita and share of total ASEAN trade (2009)

Source: Author, compiled from many sources.

As can be seen in the above table, Indonesia has the highest population with 229,965,000 people, while Singapore has only just more than 4.5 million. However, the GDP per capital of Singapore is the highest expressed as $62,100/person per year compared to the three least developed countries of Laos, Cambodia and Myanmar. Vietnam is crowded with nearly 90 million people in the square of 331.212 km²; the GDP/person per year is not high at USD 3,100 and its import and export share in the region is ranked fifth of all the States.

The target of the region in the declaration of the ASEAN Economic Community Blueprint is setting up an effective ASEAN Economic Community "into a region with free movement of goods, services, investment, skilled labor and freer flow of capital". At the 18th ASEAN summit, the AEC set up certain regulatory issues in implementing intra and extra ASEAN commitments and an Integration Monitoring Office (AIMO) to support the process of the fast implementation of the AEC. This gives effort to make ASEAN a single market and production base, a highly competitive economic region, a region of equitable economic development and a region fully integrated into the global economy. (ASEAN, ASEAN Economic Community Blueprint , 2008-2009)

Additionally, trade and services are anticipated as vital sources of ASEAN in developing the economy. Member countries have implemented liberalized trade in services on unilateral, regional and multilateral fronts. The Association has had its own unilateral and multilateral liberalization framework agreement of services (AFAS) since 1995, regionalism can act stably, politically, economically and financially. (ESCAP, ASEAN and Trade integration, 2009)

Eventually, the ASEAN Free Trade Area (AFTA) has been virtually set up. By 1/1/2010 Thailand, Malaysia, Philippines, Indonesia, Singapore and Brunei (ASEAN – 6) had eliminated import duties on products and the remaining countries will eliminate duties by 1/1/2015. This event will create the chance for members to trade more with each other as well as to enhance competition between the enterprises of each country.

4.1.2 Transport system between member countries

Transportation and communication infrastructure contribute significantly to develop trade and attract investors, especially when there is an interconnection among countries in a region like ASEAN. Thus it will support the broadening of business activities and use the facilities and means of transport efficiently and effectively. Moreover, capital in developing countries is not always available to invest in high technology which is

essential for transport and facilities such as roads, railways, ports, warehouses, container freight stations and handling equipment. Another issue for multimodal transport is procedures and documents, especially customs procedures, so cooperation will help the member countries develop infrastructure homogeneously and reduce time and costs when implementing multimodal transport for customers.

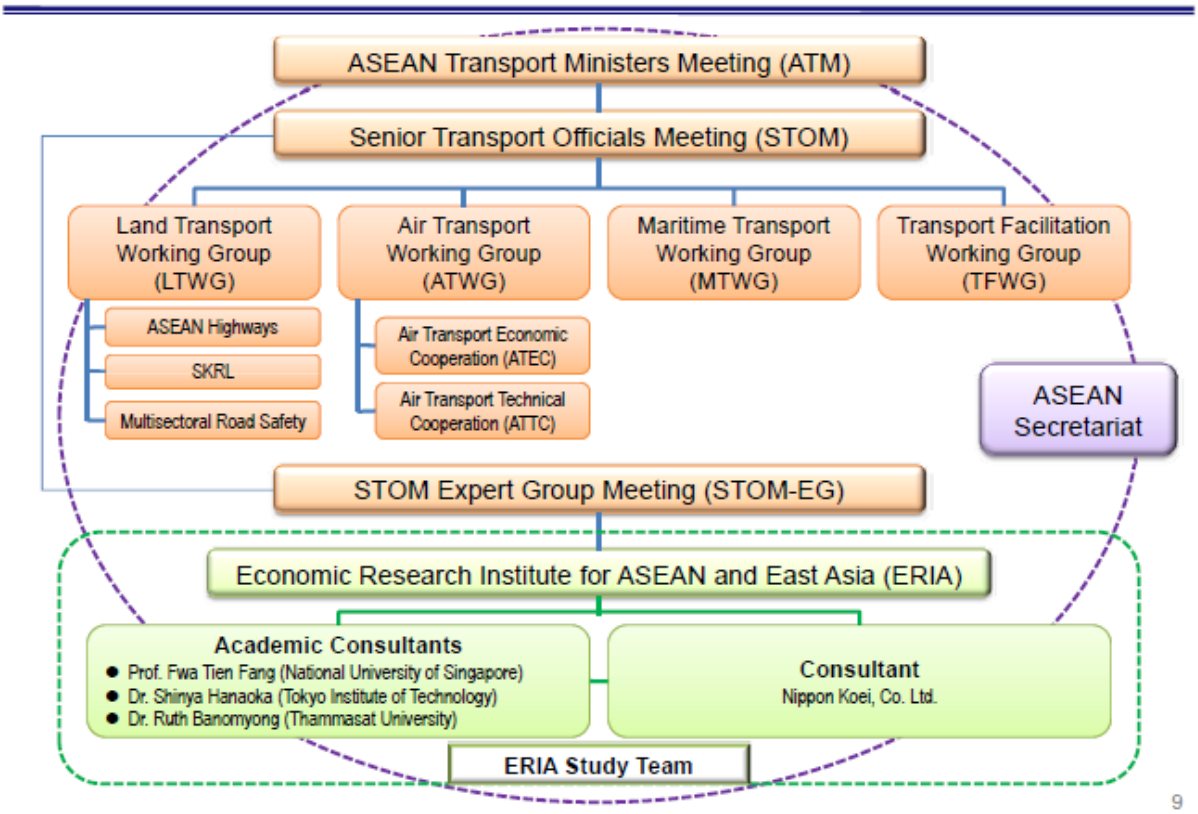


Figure 4.2: Organizational Structure of the ASEAN Strategic Transport Plan (ASTP) Project and the List of Contributors Source: ERIA study Team

Source: ERIA study team.

In the ASEAN countries nowadays, there are good opportunities to develop multimodal transport because of the containerization and upgrading of transportation infrastructure

as well as communication improvements. From 1999 to 2003, the ASEAN countries focused on developing the trans-ASEAN transportation network, setting up policies, agreements on facilitation and encouraging development studies and projects. (Wisetruangrot, 2005)

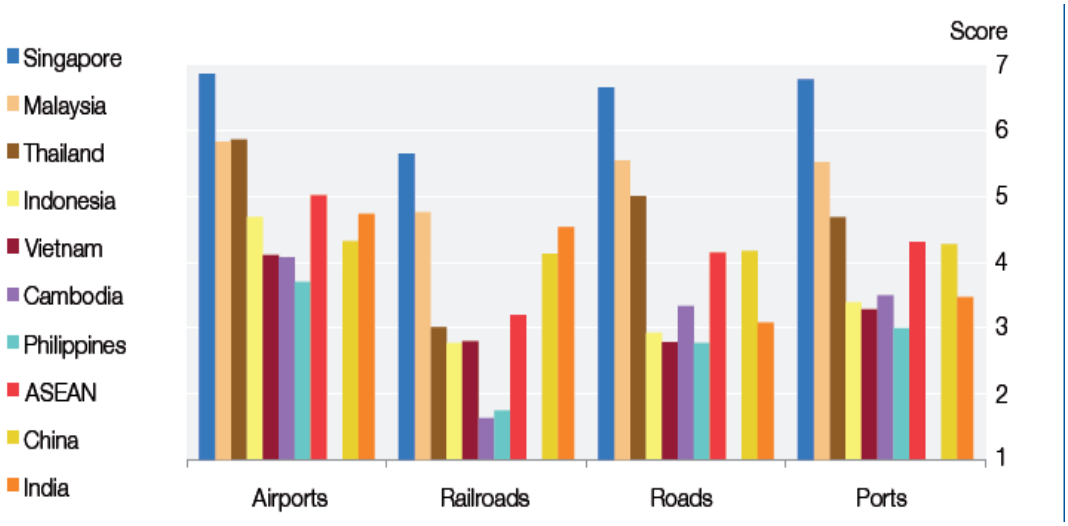


Figure 4.3: ASEAN Infrastructure quality

Source: World Economic Forum, *Executive Opinion Survey 2008, 2009*

In this graph, it is easy to recognize that the infrastructure of Singapore, Malaysia and Thailand is quite good compared to other countries such as Cambodia, Philippines and Vietnam. Thus, it can be clearly seen that Singapore, Malaysia and Thailand have important deep-sea ports as well as gateway ports in the South East Asia region. It is important to emphasize that infrastructure is very important for countries to broaden their commerce.

To do this successfully it is estimated that the required investment in infrastructure from 2006 to 2015 is about USD600 billion, of which transport will require about USD157 billion. Nearly 40% of this money will be used for maintaining the existing system, with the remaining 60% to be used to build new infrastructures. In 2009, the ASEAN

members signed the Comprehensive Investment Agreement to attract more individual investors through the open and free investment area. (M. D. Hanouz and T. Geiger, 2010)

Eventually, the ASEAN Transport Action Plan (ATAP) 2005-2010 that was adopted in 2003 to attract more private investors, established 48 actions to enhance the connection of multimodal transport, encourage the seamless move of goods and people, liberalization in the air and maritime transport services, improvement of transport services and logistics system integration. Furthermore, there is the ASEAN Highway Network Project signed in 1999 that aimed to upgrade a total of 38,400 kilometres of 23 designated routes into four-lane, asphalted highways.

The ASEAN members have the common idea of setting up important routes to promote the transport of goods in the region. Moreover, new railroads are being established, road quality is being upgraded, and procedures and custom barriers are being reduced or simplified, all this step by step.

Equally important, two big projects are underway: the Singapore-Kunming (SKRL) railroad and the ASEAN road (AHN). SKRL will run from Singapore via Malaysia, Myanmar, Thailand, Laos, Cambodia, Vietnam and terminating at Kunming – China. Malaysia is implementing some solutions to attract investment in SKRL through conferences and exhibitions about the routes. AHN will try to build and upgrade the transshipment route.

In December, 1999, the Transport Ministerial Agreement on the development of the ASEAN road network at the ASEAN Transport Ministers (ATM) 5th Conference was signed where ASEAN members agreed on the shape of the road network including routes that each member was appointed to join. In addition, each of the countries should repair and upgrade their national roads belonging to the ASEAN road network following the standard and minimum technical requirements. The routes will transverse big cities

and potential regions, which can connect with ports, and will have a high technical standard to meet the demands in moving transshipment and transnational goods. The ASEAN road network system will be fully upgraded and completed in 2020.

The figure below shows the way cargoes are transported among member countries. As shown in figure 4.4, maritime transport has developed remarkably in Singapore; this country is the gateway port, or transshipment port, to transport cargoes to Europe and America. In addition to maritime transport, road transport has also developed in the seven countries having borders with each other,

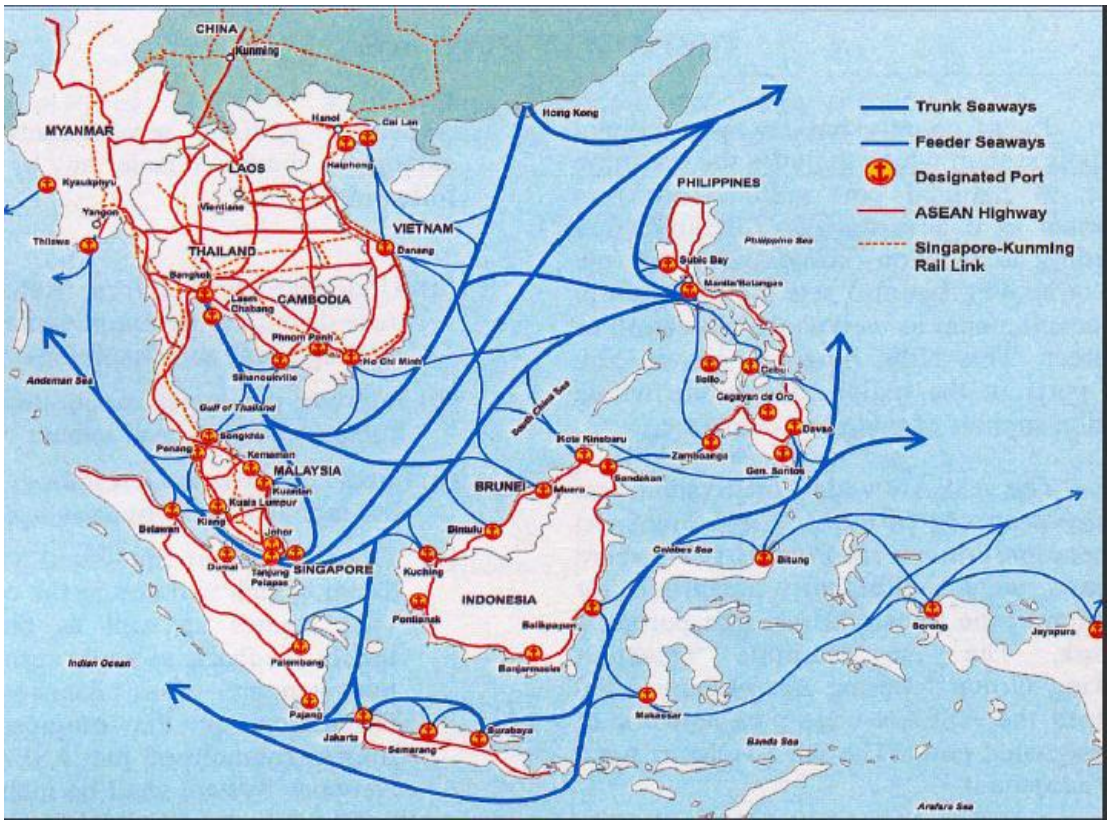


Figure 4.4: ASEAN Port Network System

Source: ASEAN Maritime Transport Development Study (2002), *Final Report Summary 2002*, Manila: Association of South East Asian Nations.

In terms of multimodal transport, the ASEAN Framework Agreement on Multimodal Transport was signed in 2005 at the ATM 11 conference to supply "door to door" services throughout the ASEAN region by using different modes of transport and only one document.

4.2 Transportation cooperation among ASEAN countries

4.2.1 Giving reasons and the need for transport cooperation among ASEAN countries

Transport and communication development is a prerequisite to promote trade among countries. At Manila on 15th of December 1987, leaders of 10 ASEAN members agreed that "the existing transportation system shall be strengthened to ultimately form an overall ASEAN transportation network". ASEAN Manila Declaration (1987)

value in US$ million; share in percent

Partner country/region	Value			Share to total ASEAN trade		
	Exports	Imports	Total trade	Exports	Imports	Total trade
ASEAN	199,587.3	176,620.1	376,207.3	24.6	24.3	24.5
China	81,591.0	96,594.3	178,185.4	10.1	13.3	11.6
EU-25	92,990.9	78,795.0	171,785.9	11.5	10.8	11.2
Japan	78,068.6	82,795.1	160,863.7	9.6	11.4	10.5
USA	82,201.8	67,370.3	149,572.1	10.1	9.3	9.7
Republic of Korea	34,292.9	40,447.4	74,740.3	4.2	5.6	4.9
Australia	29,039.3	14,810.8	43,850.1	3.6	2.0	2.9
India	26,520.3	12,595.5	39,115.8	3.3	1.7	2.5
Canada	5,500.4	3,539.2	9,039.6	0.7	0.5	0.6
Russia	1,660.6	5,104.9	6,765.5	0.2	0.7	0.4
New Zealand	3,137.6	2,238.6	5,376.2	0.4	0.3	0.3
Pakistan	3,833.8	469.6	4,303.4	0.5	0.1	0.3
Total selected partner countries/regions	638,424.5	581,380.8	1,219,805.2	78.8	80.0	79.4
Others 2/	172,064.7	144,973.3	317,038.0	21.2	20.0	20.6
Total ASEAN	**810,489.2**	**726,354.1**	**1,536,843.3**	**100.0**	**100.0**	**100.0**

Source ASEAN Merchandise Trade Statistics Database (compiled/computed from data submission, publications and/or websites of ASEAN Member States' national ASEAN Free Trade Area (AFTA) units, national statistics offices, customs departments/agencies, or central banks)

Symbols used
- not available as of publication time
n.a. not applicable/not available/not compiled
Data in *italics* are the latest updated/revised figures from previous posting.

Notes
Some figures may not add up to totals due to rounding off errors
All figures are preliminary; data exclude Cambodia and Lao PDR as they are not available

1/ Includes Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and United Kingdom
2/ Includes of all other countries and those that could not be attributed to specific countries

Table 4.3: ASEAN trade by region (2009)

Source: External trade ASEAN statistics

The ASEAN Plan of Action in Transport 1996-1998 was conducted successfully to integrate the regional market and promote the coordination in transportation, communication and infrastructure sectors. The ASEAN Transport Cooperation Framework Plan was established to support and assure the implementation of the "ASEAN vision 2020" and "the Hanoi Plan of Action". From 1999 to 2004 there were 55 projects and activities focusing on five sectors: transport facilitation, air transport, land transport, maritime transport and integrated transport development in the ASEAN based on five strategies, which are the development of infrastructure, promotion of competitive transport services, capacity building initiatives, improving transport safety and environment and greater private sector participation.

The ASEAN also cooperates with other countries including the USA, Canada, Japan, EU and Australia beside cooperation within the region. This strategy will help ASEAN improve services with higher frequency and lower costs, while taking the advantage of the natural resources available and low labor costs.

In particular, the ASEAN plan of action in transport and communication (1997) was supported by technical assistance and finance from many countries. Australia with a study on "Open skies", China and Belgium with the management of human resources development in river transport and road traffic, Japan with safety of road and maritime transport, intelligent transport systems and urban transport while the Republic of Korea helped with highway construction and Germany planned for handling dangerous goods in ports.

4.2.2 Legal basis and programmes to develop the multimodal transport system of ASEAN

At the moment of writing (October, 2010), there is a United Nations Convention on International Multimodal Transport of Goods, but this has not entered into force yet. However, ASEAN has considered multimodal transport as the first priority in

transportation and traffic development. This was specified as one of seven action programmes on transportation and communication in the ASEAN countries of the Senior Transport Officials Meeting (STOM) in Thailand 1997. (UNCTAD Secretariat, 2001)

Also, the ASEAN Transport Ministers (ATM) and Senior Transport Officials Meeting (STOM) had a lot of meetings to reach a Framework on Multimodal Transport including 10 chapters and 36 articles. The content of the Agreement was based on the United Nations International Convention on Multimodal Transport 1980, the UNCTAD/ICC Rules for Multimodal Transport Documents, the Cartagena Agreement of the ANDEAN countries on Multimodal Transport (1993) and business practices in the ASEAN countries.

Furthermore, at the end of October 2001, the 7th ASEAN Transport Ministers meeting convened in Malaysia to sign the draft of the "ASEAN Framework on Multimodal Transport". This agreement has become a prerequisite for the cooperation of ASEAN on multimodal transport and is a common legal basis that has created many opportunities for developing multimodal transport in these countries.

The purposes of the agreement are to prescribe a common legal basis involved in multimodal transport, and from that point it can promote the development of this service thoroughly, economically and effectively. Developing multimodal transport helps broaden mutual trade among countries as well as trade with other countries outside ASEAN. The Agreement also creates a balance of interests between people who provide and use international services in ASEAN. The framework includes 11 chapters and 42 articles.

From 1977 to 1994 cooperation activities involving transportation and communication were directed by COTAC ASEAN (Cooperation in transport and communication). From 1997, there were about 100 projects set forth but the number completed was not great. Cooperation was mainly in the fields of sea transport and ports, roads, civil aviation,

related services like post offices and communication. At that time there were four main agreements signed: the Multilateral Agreement on Commercial Rights of Non-Scheduled Air Services among the Association of Southeast Asian Nations in 1971, the Agreement for the Facilitation of Search of Aircraft in Distress and Rescue of Survivors in Aircraft Accidents, 1972, Ship Search and Rescue Agreement, 1975 and the ASEAN Framework Agreement on Recognition of Driving Licenses, 1995.

4.2.3 Road and rail transport

Road and rail transport are important elements of multimodal transport and must be prioritized. The Governments have purpose of focusing on four aspects related to road transport

- Transportation in big cities: cooperating in ASEAN in solving the problems that have to be faced.
- Road safety: increasing the safety level through methods such as checking, assuring the safety of roads, building new roads and transportation awareness.
- Human resource development: enhancing the knowledge and skills of managers and staff to plan, manage and administrate road systems.
- Transportation planning and activities: improving and harmonizing the road transport network in member countries and law standardization in making it easy to move goods and people among the ASEAN countries.

Figure 4.5: Singapore – Kunming Rail Link

Source: ASEAN (1999). Mekong Railway Project. Retrieved June 5, 2011 from the World Wide Web: http://www.cbre.com.kh/2010/09/mekong-railway-project/

The Singapore-Kunming rail project runs through Singapore, Malaysia, Thailand, Cambodia, Vietnam, Laos, Myanmar and ends in China. It is estimated to be completed in 2015 at a cost of around US$11 billion.

However, since there is a shortage of capital, which has lead to lower standards for international truck facilities at border crossings, not many TIR (Transport International

Routier) agreements have been signed making it difficult for trucks to travel between countries with transshipment goods.

With rail transport, a major problem is the shortage of wagons carrying more than 80 tonnes, and 50 foot wagons.

4.2.4 Sea transport and ports

The Agreement of ASEAN in 1980 on sea transport and commerce was a guideline for the cooperation between countries in this respect. The purposes of this agreement were setting up stable and reasonable freight rates as well as providing efficient and economic sea transport services within the region or outside ASEAN. Some of the main activities were to broaden and modernize ASEAN fleets, promoting the cooperation of commercial vessels, minimizing the restraints in sea transport, encouraging the establishment and upgrading of national information systems in transport goods registration, setting up more ASEAN sea transport committees, increasing the role of ASEAN Port Authorities Association and ASEAN Shipowners Association, and establishing an advanced environment for the closer cooperation among ASEAN government and private sectors including non-government organizations.

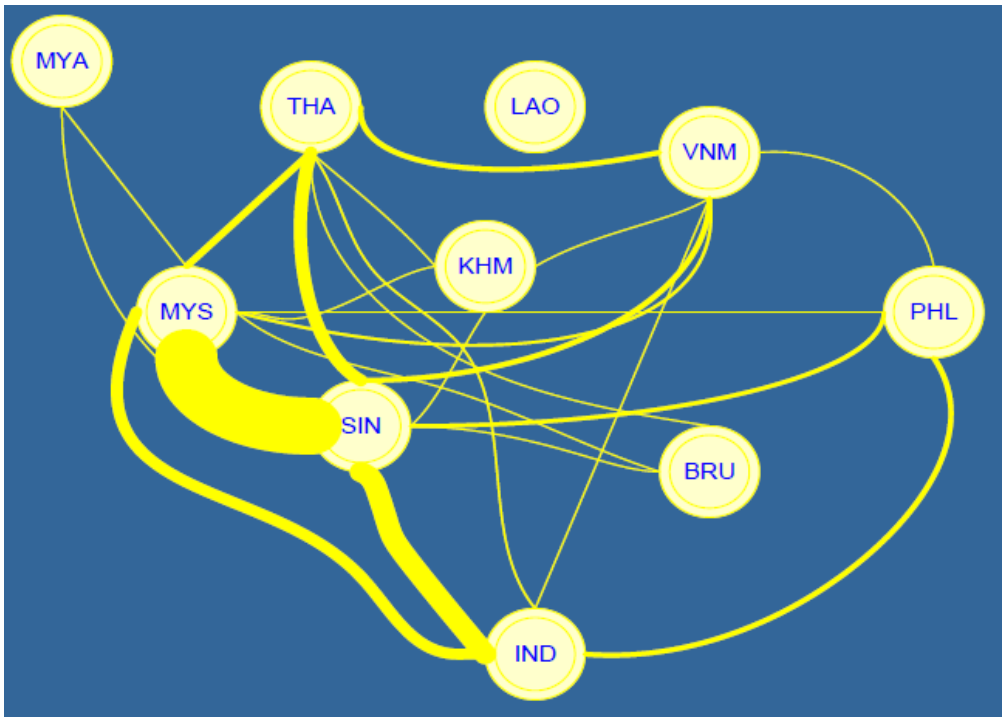


Figure 4.6: Container Shipping Services in South East Asia

Source: Najoan, J. E. & Sutomo, H. (2005). *Short Sea Shipping As An Alternative For ASEAN*. Surabaya, Indonesia.

ASEAN countries have implemented some projects such as training, information exchange, economic and technical research, providing sea transport services, safety at sea and harbours as well as setting up a common stance of ASEAN concerning international transportation matters.

In terms of safety at sea the target has been to enhance the safety of ships and sea transport in the ASEAN sea region. Here member States have set up information in electronic boards, which include an ASEAN vessels information system and a response plan to deal with accidents at sea and pollution.

The weaknesses of sea transport are the links with other transport modes, poor equipment for handling cargoes and the time to process customs procedures and transit cargo.

4.2.5 Air transport and related services

Ensuring safety through cooperation within air transport and improving the air traffic control system have been seen as priorities in air transport. The list below shows the cooperation in terms of air transport services in the South East Asian region:

- Cooperation in policy: from the year 1990, annual meetings of the Chief Executives and Senior Executives of ASEAN airlines have been organized, and in 1992 the ASEAN International Airport Association was established.
- Cooperation in Economic and technical research.
- Cooperation in human resource development.
- Cooperation in professional and information exchange.

A Senior Economic Officials Meeting (*SEOM*) was first organized in 1994 at Jakarta which set up a working team for the transport and communication sectors. This team developed a program called "ASEAN activities planning on transport and communication" and broadened "Open ASEAN sky policy". In 1996, the Ministers of Transport of the ASEAN countries signed an agreement to set up a transportation cooperation mechanism and Senior Transport Officials Meetings. Ministers also defined the goals for cooperation in the transportation sector:

- Setting up and developing a harmonized and unified transport system.
- Building up a close and flexible transport network among members and with other regions.
- Promoting transport cooperation to reach the purposes of the ASEAN Free Trade Area.

- Setting up a mechanism to supervise the implementation of projects and other activities involving transportation.

With support from the ASEAN Secretariat, STOM is to cooperate in the following aspects: urban transport, aviation, human resource development, setting up an ASEAN railway centre and a human resource training centre for ASEAN's inland waterway and railway system. The last item is the coordination of sea traffic management tools that still respect the testing procedures of the individual ASEAN members' ports.

There are seven cooperation programmes:

- Developing multimodal transport and promoting trade.
- Enhancing the close connection among ASEAN members in terms of communication, promoting the development of road, sea and air transport.
- Integrating the legal systems and transport rules in the ASEAN countries.
- Completing the aviation management system in the ASEAN.
- Developing human resources for transportation and communication.
- Implementing safety at sea and forecasting pollution caused by vessels.
- Developing the competition policy in aviation services to support the conduct of the "Open ASEAN sky" policy.

Air transport in ASEAN countries needs to invest more in facilities such as cold storage, handling equipment and dangerous goods stores.

4.3 The results reached after cooperation in multimodal transport

In order to maintain and develop the status of the ASEAN in the world, there is a need for coherent policies at the regional and sub-regional levels (UNCTAD, 1989).

Trade cannot be conducted without transportation. Transport adds more value to the goods. Transport becomes an integral element contributing to the production line and

meeting the requirement to reduce cost of storage and multiple handling through the concept “Just in time”.

In 2010, the main ports in the ASEAN countries loaded and discharged nearly 62.6 million TEUs compared to 55.3 million TEUs in 2009. Singapore had the highest number of throughput containers, Port Klang, Port Tanjung Pelepas (Malaysia) and Laem Chanbang (Thailand) also received many large vessels and holds a big share in the port market in South East Asia.

Ports	***2008***	***2009***	***2010***	***Compared of 2010 to 2009***
Bangkok	1.45	1.22	1.45	18.8
Laem Chabang	5.13	4.54	5.07	9.5
Ho Chi Minh (Cai Mep)	3.43	3.71	4.3	10.8
Manila	2.98	2.82	3.22	14.2
Port Klang	7.97	7.31	8.87	12.2
Port Tanjung Pelepas	5.6	6.02	6.53	8.5
Tanjung Priok	3.98	3.8	4.71	23.6
Singapore	29.9	25.9	28.4	9.7
Total	60.44	55.32	62.55	

Table 4.4: Throughput comparison of main ports in the ASEAN (2008 to 2010) in million TEUs

Source: Containerisation International, Solid foundation, 2011

Cargo handling equipments in some main ports are not enough and demands for new terminals are appearing to meet the developments in the trading of goods.

The free trade agreement between China and the ASEAN bloc was fully implemented in January, 2010. According to Dr Surin, Secretary General of the ASEAN group of countries, "the ASEAN bloc has the capacity to be the supply chain for China's booming economy which has been further liberalised by the ASEAN-China FTA". The trade between ASEAN and China increased about 26% annually from 2003 to 2008. (Well-stacked, 2011)

Trade lane	***2009 (TEUs)***	***2010 (TEUs)***	***% increase***	***Forecast 2011 (TEUs)***
Chinese exports to ASEAN	2,659,074	3,251,589	19.5	3,887,104
Chinese imports from ASEAN	1,674,388	1,858,249	1,5	1,885,256

Table 4.5: Cargo flow to/from China-South East Asia (in TEU)

Source: Containerisation International, China-ASEAN rate drop after FTA, p.14, January 2011

The Free Trade Area wishes to increase over-land trading opportunities. Kerry Asia Road Transport (KART) is going to run in ASEAN and China with the purpose of connecting land/sea and land/air traffic. The table above shows that in 2010 the number of TEUs exported to China from ASEAN countries increased by 19.5% compared to 2009, while the number of TEUs imported from China rose only 1.5%. China is always the big market of South East Asian nations, both in terms of imports and exports.

The second biggest export market of ASEAN is the European Union. The share of total EU imports in 2010 was about 5.8%. On the other hand the export share was nearly 4.5% of the total trade of ASEAN.

European Union, Trade with ASEAN

millions of euro, %

Period	Imports	Variation (%, y-o-y)	Share of total EU Imports (%)	Exports	Variation (%, y-o-y)	Share of total EU Exports (%)	Balance	Trade
2006	78.818	10,0	5,8	48.811	7,8	4,2	-30.007	127.629
2007	80.499	2,1	5,6	53.091	8,8	4,3	-27.407	133.590
2008	79.743	-0,9	5,1	55.701	4,9	4,3	-24.042	135.445
2009	67.967	-14,8	5,6	50.296	-9,7	4,6	-17.671	118.262
2010	86.374	27,1	5,8	60.635	20,6	4,5	-25.739	147.009
2010Q1	18.659	.	5,6	13.923	.	4,7	-4.736	32.582
2010Q2	21.090	.	5,6	14.757	.	4,4	-6.333	35.846
2010Q3	23.613	.	6,1	15.546	.	4,4	-8.067	39.159
2010Q4	23.012	.	5,7	16.409	.	4,5	-6.603	39.421
2011Q1	23.788	27,5	5,7	16.278	16,9	4,4	-7.510	40.066
2011Q2	.	.	.	.	.	.	.	.
2011Q3	.	.	.	.	.	.	.	.
2011Q4	.	.	.	.	.	.	.	.
Average annual growth (2006-2010)		2,3			5,6			3,6

Table 4.6: EU's trade balance with ASEAN

Source: EUROSTAT (Comext, Statistical regime 4)

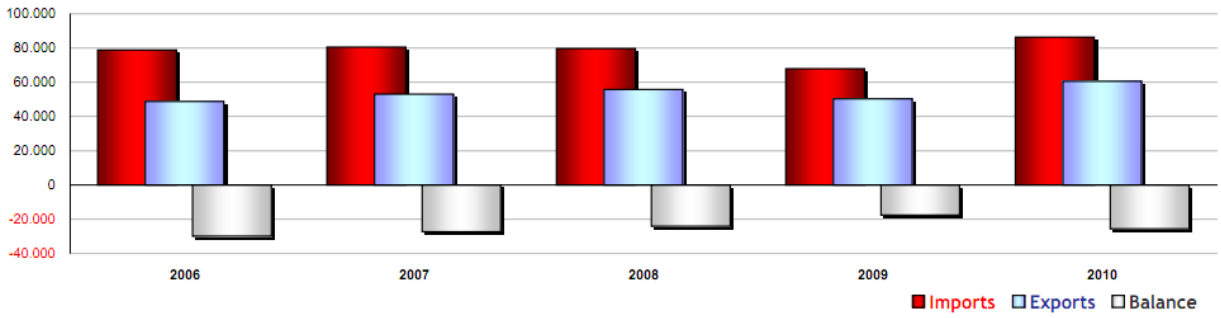


Figure 4.7: ASEAN trade with EU (2007-2009)

Source: EUROSTAT (Comext, Statistical regime 4)

The value of imports from Europe is higher than the exported value to Europe. The Association has recognized the importance of this market, so it has to try its best to keep the market share and improve the trade balance between the two regions.

Another big market of ASEAN is North East Asia, the total trade between ASEAN and North East Asia in 2010 also grew by 16.4% compared to 2009. However, the massive Japanese earthquake (8.9 richter scale) and tsunami on 11th of March 2011 has restrained the activities significantly. Mr. Wong, APL's Vice President for the in-Asia, Middle East and Australia trade, said another problem in the ASEAN countries is outdated port infrastructure leading to the failure to meet the requirement in transporting and handling cargo.

The Ministries of Transport of the ASEAN countries and Japan have reviewed 21 projects in which they have cooperated with each other and adopted an Action plan in implementing these 21 projects in 2005 and 2006. Additionally, a logistics and transportation improvement plan and a common plan for a new aviation system between ASEAN and Japan will soon be implemented.

Direction/year	***2006***	***2007***	***2008***	***2009***
Southbound				
Japan	1,928,809	2,323,708	2,560,764	2,393,624
South Korea	675,280	728,961	788,716	638,025
Northbound				
Japan	1,777,401	1,987,541	1,937,457	2,273,612
South Korea	6,064,942	6,851,167	7,217,070	7,091,638

Table 4.7: ASEAN trade with North East Asia (2007-2009)

Source: Containerisation International, Head of the queue, p.50, April 2010

As shown in table 4.7, the two North East Asia countries, which have a large number of containers exported and imported to ASEAN are Japan and Republic of South Korea. Nonetheless, the crisis in 2008 led to the decrease in container trade between these countries.

In addition, the United States is a good and large market for Southeast Asian nations. It can be seen clearly in the table 4.8 below that the quantity of cargo transported Eastbound increased while the cargo transported Westbound decreased from more than 1.5 million in 2008 to nearly 1.3 million in 2009.

Direction/year	***2006***	***2007***	***2008***	***2009***
Westbound	1,363,398	1,524,524	1,514,920	1,279,356
Eastbound	785,918	801,771	821,262	896,211

Table 4.8: ASEAN trade with the USA (2007-2009)

Source: Containerisation International, Head of the queue, p.50, April 2010

Most ASEAN countries are identified as regional short-sea and feeder operators. Only some ports in this region can be called at by large vessels and belong to the global service networks.

Land transport: the purpose of cooperation among ASEAN members in land transport is to create efficient, economical and safe corridors to connect the 10 members through the ASEAN Highway Network project, which is mostly located in Myanmar. However, in order to develop land transport, the infrastructure of these countries needs to be improved. The Singapore-Kunming Rail Link is another project that started in 1995 and is expected to be completed in 2015. This route will be Singapore-Malaysia-Thailand-Cambodia-Vietnam-Thailand.

Inland waterways: the big advantage of inland waterways is saving costs. The cost is very low, especially in the ASEAN, because there are many rivers in the ASEAN countries, totalling over 51,000km in length. However, the ASEAN member states have not taken this advantage, which is proven by the fact that the infrastructures, like the port facilities are very poor and difficult to link with other countries. River ports should be improved in terms of infrastructure as well as rules and regulations to connect with each other more easily and to contribute to maritime transport.

Maritime transport: maritime transport is the strong point of almost all ASEAN countries except one land-locked country, Laos PDR. However, according to the liner shipping connectivity index issued by UNCTAD, the situation could be better.

Country	***2008***	***2009***	***2010***
	Index		
Brunei	3.68	3.94	5.12
Cambodia	3.47	4.67	4.52
Laos			
Indonesia	24.85	25.68	25.6
Malaysia	77.6	81.21	88.14
Myanmar	3.63	3.79	3.68
Philippine	30.26	15.9	15.19
Singapore	94.47	99.47	103.76
Thailand	36.48	36.78	43.76
Vietnam	18.73	26.39	31.36

Table 4.9: UNCTAD liner shipping connectivity index 2008-2010

Source: UNCTAD, calculated from data of Containerization International Online, www.ci-online.co.uk.

According to Professor Lauri Ojala “The liner shipping connectivity index (LSCI) measures the connectivity of container shipping connectivity of countries based on number of container ships, container capacity of ships, maximum vessel size, number of services and number of carriers sailing from and to a country’s ports” (Ojala, 2011) . In addition, it shows the accessibility to international trade. The high value of the index means that this country can access to the global maritime freight transport system easily. As can be clearly seen in the table 4.9, most of the countries in ASEAN, except Singapore and Malaysia, do not have a high connectivity index. It is necessary for all members to attract more investment to achieve deep integration within ASEAN.

Air transport: facilities are important to develop air transport, especially runways and warehouses. The big problem in ASEAN countries is the shortage of warehouses, although member nations are trying their best to improve facilities. For example, ASEAN has developed passenger and freight air services, based on the Skytrax ranking indicator to rank the air services performance of South East Asian countries from 1 star to 5 stars.

CHAPTER 5: THE RELATIONSHIP OF THE MULTIMODAL TRANSPORT SYSTEM OF VIETNAM WITH THE MULTIMODAL TRANSPORT SYSTEM OF ASEAN COUNTRIES.

5.1 Transportation and logistics service of ASEAN countries

5.1.1 Introduction

Today, the trade with other ASEAN countries consists of 25% of the total import- export turnover of Vietnam. ASEAN plays an important role in developing the Vietnamese economy and ASEAN is a big market for developing logistics service. When Vietnam promotes the integration process in logistics, it will help Vietnam become a logistics centre that provides logistics services for all the nations in ASEAN and creates a chance to acquire experience from the top logistics service providers in the region.

There is not always cooperation among ASEAN countries, as there are still some areas of conflict and competition. Examples of these competitions among countries are the movement from Singapore to Malaysia in 2000 of the Maersk hub port and when the APL round the world service chose Thailand's Laem Chabang port as a hub port instead of Singapore.

	Rail	***Road***	***Sea***	***Air***	***Inland waterway***
Speed	Low	High	Very low	Very high	Very low
Cost saving	High	Low	Very high	Very low	Very high
Reliability	Very high	Very high	High	High	High
Safety	Very high	High	High	Very high	Very high
Flexibility	Low	Very high	Very low	Low	Low
Availability	Low	Very high	Low	High	Very low
Environment friendly	Good	Very poor	Very good	Good	Very good
Infrastructure cost	Very heavy	Heavy	Heavy	Heavy	Various
Infrastructure maintenance cost	High	High	Low	Low	Various
Vehicle size	<3000T	<40T	>3000T	<100T	<5000T
Door to door potential	Low	Very high	Very low	Low	Very low
Suitable cargo	All	General cargo	All	General cargo	All
Economical distance	Long	Short	Long/very long	Long/very long	Long

Table 5.1: Comparison of Major Transport Modes

Source: Ma, S. (2011). *Logistics.* Unpublished lecture handout, World Maritime University, Malmo, Sweden.

As can be seen clearly in the above table, sea and inland waterways seem to be the most economic, safe and environmental. In addtion, cargoes are usually transported over long distances. While air transport is more reliable and flexible, saving time is the biggest advantage of transporting by air, however, the air freight is expensive and it is only suitable for high value and perishable cargo. Rail and road are good choices between sea and air transport with suitable freight and the time is flexible. It all depends on what kind of cargo and the priorities of companies and shippers in the transportation of the goods.

	Port	Airport	Railway	Road
Cambodia	Poor	Fair	Poor	Poor
Indonesia	Poor	Fair	Good	Fair
Laos	Not applicable	Poor	Not applicable	Fair
Malaysia	Good	Good	Good	Good
Philliphines	Fair	Fair	Poor	Fair
Singapore	Good	Good	Good	Good
Thailand	Good	Good	Good	Good
Vietnam	Fair	Fair	Fair	Fair
Burma	Poor	Poor	Poor	Fair

Table 5.2: Logistics Infrastructure of Countries in ASEAN

Source: www.Business-in-Asia.com, 2006-2007

5.1.2 Some main ports in ASEAN countries.

Port Klang is a transit hub port for cargoes mainly from Australia and New Zealand to Europe and South-East Asia and cargoes from West India and the Gulf for South-East and East Asia and the US Pacific coast. (ESCAP, Regional Shipping and Port

Development Strategies, 2001). Port Klang is expected to handle 9.6 million 20”containers in 2011. In ASEAN, Port Klang is one of the busiest ports with 54 berths and with a total berth length of 11.7 thousand meters. It can handle vessels up to 130,000 DWT (only 12 berths). (World Port Source, 2011)

Singapore is always the best choice transshipment port in ASEAN. The cargoes from and to ASEAN countries, which are transited in Singapore, hold about 70% of the market share. Singapore is the logistics centre in Asia, where there are enough facilities to serve large vessels as well as being able to connect with other ports as transshipment ports. The Port of Singapore may be the best port in ASEAN and it is the hub port for all the countries in the region. It receives around 140,000 vessels, which carry 30 million containers, 500 million tons of cargo and a million cruise passengers each year. (World Port Source, 2011)

Tanjung Pelapas: in the future, the port of Tanjung Pelepas (PTP) has the potential to become a big hub port to compete with Singapore to attract South East Asian countries. It is estimated that 86% of cargoes will come to PTP from ASEAN during 2011. (ESCAP, Regional Shipping and Port Development Strategies, 2001). The port of Tanjung Pelapas lies in the centre for both local transport as well as international and it can compete with the Port of Singapore to become the big hub for ASEAN ports. There are currently 6 berths in the Port of Tanjung Pelapas and the deepest has a draft of 15 meters. (World Port Source, 2011)

Cambodia: Cambodia has two ports, Phnom Penh port is a river port in the capital of Cambodia and the international port, Shihanoukville, which is 240km away from Phnom Penh.

Philippines: there are three main container terminals in Manila. Manila International Container Terminal (MICT) has five berths, aquay length of 1300 meters, a depth of 10.5-14 meters and 10 quay cranes, 7 of which are post panamax. The North Habour has

a low draft of 5.5 meters while the South Habour has a draft of 12m and is equipped with 7 gantry cranes.

Thailand: maritime transport in Thailand carries about 86% of the country's total freight volume. There are two ports in Thailand, Laem Chabang and Bangkok. Laem Chabang can be seen as a hub port for the East-West trade. Airports in Thailand include Suvanabhumi, Chiang Mai, Chiang Rai, Hat Yai and Phuket. The railway network connects Malaysia through Padang Besar and Sungai Kolok. The other railway network is the connection between Laem Chabang and Lat Krabang Inland container depot. The Road network includes the Asian network that connects Thailand with other neighbouring countries such as Myanmar, Laos, Cambodia and Malaysia.

The facilities of Laos: Laos is the only land-locked country in ASEAN. There are two airports, one is Vientinne and the other is Luang Prabang, however the demand is very low and they do not have enough facilities to handle cargoes nor to keep cargoes. The strong point of Laos is its road network which includes 2,298km of the Asian highway. A railway network is not developed. (K.I.Asia, 2010)

Moreover, many countries are chosen as the transshipment places through crossing border nowadays. Neighboring countries encourage trade and create many opportunities to help import and export cargo entering each other countries easily and quickly.

	Vietnam	***Cambodia***	***Laos***	***Thailand***	***Singapore***
Rank in trading across border cost in the world	67	122	165	10	1
Procedure of exporting					
Document preparation	115	220	120	270	105
Custom clearance and technical control	100	262	10	50	31
Port and terminal handling	369	100	130	85	180
Procedure of importing					
Prepare for document	70	210	120	300	88
Custom clearance	100	265	20	75	31
Handling charge	431	217	300	200	180

Table 5.3: Country level costs of trading across border (USD)

Source: International Finance Corporation (IFC), "Doing Business 2008" database.

5.2 Intermodal transport optimization model

This part of the dissertation focuses on analysing and finding the optimum cost and freight for a 20 foot container from Laos to Singapore via Thailand or Vietnam and from Bangkok to Vietnam via Phnom Penh using the Zero-one goal programming model combined with integer linear programming and the Analytic Hierarchy Process.

5.2.1 Choosing deviation variable factors and weighting each factor

Questionnaires were used to survey what factors logistics providers and shippers consider when choosing the mode or modes of multimodal transport to carry cargoes from the origins to the destinations. Respondents have ranked the required level of each factor in 4 classes: 1: very necessary, 2: necessary, 3: quite necessary and 4: unnecessary. And there are also 4 main factors that affect the choices of customers: cargo related factors, service related factors, company's strategy and other factors. Based on 51 questionnaire interviews with logistics providers, carriers and shippers in Vietnam, the results are expressed in the following tables:

	RANK			
	1	***2***	***3***	***4***
I. Cargo related factors				
Value	27	15	8	1
Percentage (%)	*52.94*	*29.41*	*15.69*	*1.96*
Volume and measurement	22	18	9	2
Percentage (%)	*43.14*	*35.29*	*17.65*	*3.92*
Weight	19	21	8	3
Percentage (%)	*37.25*	*41.18*	*15.69*	*5.88*
Weight/measurement	11	23	16	1
Percentage (%)	*21.57*	*45.1*	*31.37*	*1.96*
Packing	5	26	14	6
Percentage (%)	*9.8*	*50.98*	*27.45*	*11.76*
Specialized goods :dangerous, fragile, perishable	23	18	4	6
Percentage (%)	*45.1*	*35.29*	*7.84*	*11.76*
	RANK			
II. Service related factors	**1**	**2**	**3**	**4**
Transit time	18	27	5	1

	Percentage (%)	*35.29*	*52.94*	*9.8*	*1.96*
Cost		26	21	1	3
	Percentage (%)	*50.98*	*41.18*	*1.96*	*5.88*
Reliability and punctuality		23	22	3	3
	Percentage (%)	*45.1*	*43.14*	*5.88*	*5.88*
Customer relationship		5	30	11	5
	Percentage (%)	*9.8*	*58.82*	*21.57*	*9.8*
Frequency		7	17	19	8
	Percentage (%)	*13.73*	*33.33*	*37.25*	*15.69*
Global coverage		16	22	13	0
	Percentage (%)	*31.37*	*43.14*	*25.49*	*0*
Procedure processing time		12	27	12	0
	Percentage (%)	*23.53*	*52.94*	*23.53*	*0*
Handling equipment arrangement		11	25	15	0
	Percentage (%)	*21.57*	*49.02*	*29.41*	*0*
Legal documentation		26	19	5	1
	Percentage (%)	*50.98*	*37.25*	*9.8*	*1.96*
Secure of product		24	19	5	3

		RANK			
II. Service related factors		**1**	**2**	**3**	**4**
	Percentage (%)	*47.06*	*37.25*	*9.8*	*5.88*
Electronic Data Interchange		10	25	11	5
	Percentage (%)	*19.61*	*49.02*	*21.57*	*9.8*
Flexibility of modes of transport		7	26	17	1
	Percentage (%)	*13.73*	*50.98*	*33.33*	*1.96*
		RANK			
III. Company's strategy		**1**	**2**	**3**	**4**
Marketing strategy		13	29	5	4
	Percentage (%)	*25.49*	*56.86*	*9.8*	*7.84*
System of modal evaluation		12	25	10	4
	Percentage (%)	*23.53*	*49.02*	*19.61*	*7.84*
Management structure		6	22	17	6
	Percentage (%)	*11.76*	*43.14*	*33.33*	*11.76*
The size of company		2	13	20	16
	Percentage (%)	*3.92*	*25.49*	*39.22*	*31.37*
Capital of company		7	19	19	6

	Percentage (%)	*13.73*	*37.25*	*37.25*	*11.76*
	Investment policy	12	21	13	5
	Percentage (%)	*23.53*	*41.18*	*25.49*	*9.8*
		RANK			
	IV. Other factors	**1**	**2**	**3**	**4**
	Transport distance	15	17	16	3
	Percentage (%)	*29.41*	*33.33*	*31.37*	*5.88*
	Destination area	9	26	13	3
	Percentage (%)	*17.65*	*50.98*	*25.49*	*5.88*
	Delivery terms in contract	13	24	12	2
	Percentage (%)	*25.49*	*47.06*	*23.53*	*3.92*
	Environmental issues	6	24	18	3
	Percentage (%)	*11.76*	*47.06*	*35.29*	*5.88*
	Infrastructure of Vietnam	24	17	7	3
	Percentage (%)	*47.06*	*33.33*	*13.73*	*5.88*
	Regulation of Vietnam and other countries	20	20	9	2
	Percentage (%)	*39.22*	*39.22*	*17.65*	*3.92*

IV. Other factors	*1*	*2*	*3*	*4*
□ Facilities and ability of shipper's warehouse	12	26	12	1
Percentage (%)	*23.53*	*50.98*	*23.53*	*1.96*
□ Communication and information	15	30	5	1
Percentage (%) □	*29.41*	*58.82*	*9.8*	*1.96*

Table 5.4: Shippers' and logistics providers ranking of carrier performance

Source: Author calculated based on the result of questionnaires

Out of the four main factors, the second main factor was taken to choose variables for a zero-one goal program modelling. However, there are many sub factors in the second main factor, the three most important sub factors in the second main factor had to be calculated and decided based on Analytic Hierarchy Process (AHP).

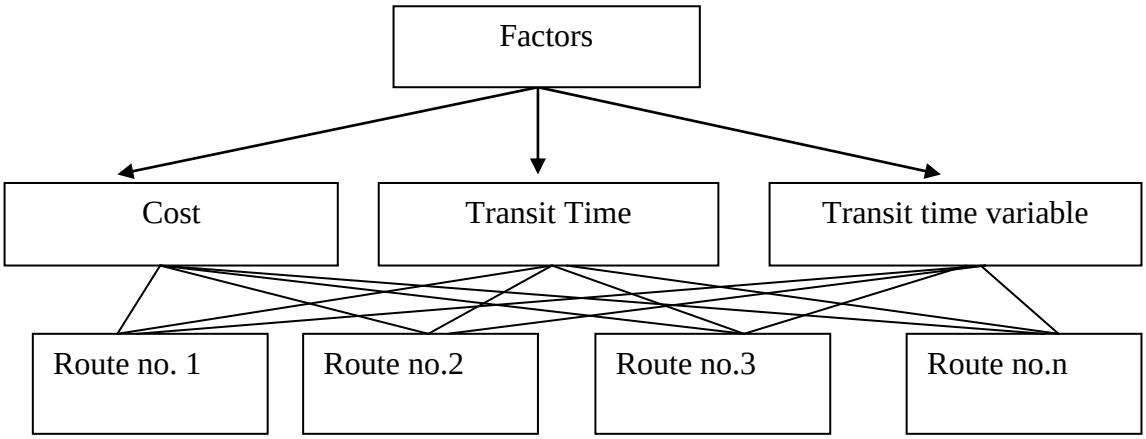


Figure 5.1: Analytic Hierarchy Process applying to multimodal transport

Source: Author's drawing based on the AHP model set up by many previous authors

In order to choose what the variables will be, the calculation was conducted according to the formula:

$$G = \frac{A*1+B*2+C*3+D*4}{51}$$

In the formula, A is the number of votes for rank 1 of each sub factor, B is the number of votes for rank 2, C is number of votes for rank 3 and D is number of votes for rank 4, and 51 is the number of people that were interviewed.

For example:

$$G_{cost} = \frac{26*1+21*2+1*3+3*4}{51} = 1.627451$$

Service related factors	Rank				G
	1	***2***	***3***	***4***	
· ***Cost***	26	21	1	3	1.627451
· ***Legal documentation***	26	19	5	1	1.627451
· ***Reliability and punctuality***	23	22	3	3	1.72549
· ***Security of product***	24	19	5	3	1.745098
· ***Transit time***	18	27	5	1	1.784314
· ***Global coverage***	16	22	13	0	1.941176
· ***Procedure processing time***	12	27	12	0	2
· ***Handling equipment arrangement***	11	25	15	0	2.078431
· ***Electronic Data Interchange***	10	25	11	5	2.215686
· ***Flexibility of modes of transport***	7	26	17	1	2.235294
· ***Customer relationship***	5	30	11	5	2.313725
· ***Frequency***	7	17	19	8	2.54902

Table 5.5: Ranking service related factors

Source: Author calculated based on AHP model

After calculation, the results express:

- The smaller the value of G is, the more necessary the sub factor is.
- The most necessary is the cost that shippers have to pay and it is the first variable.
- The second most necessary factor is legal documentation or exact documents, but this factor is very difficult to measure and convert to quantity.
- The third factor is service's reliability and punctuality, which can be translated to transit time variability. The transit time has a wide range so it is more necessary to specify the distribution than just finding the average of transit time (C. Chen, E. v. Zwet, P. Varaiya, A. Skabardonis, 2002). This factor is a little bit difficult to quantify, but it can be figured out by using the mean and standard deviation of freight and time quoted by several carriers in these routes. The optimization of multimodal transport is the trade off between cost and quality of service supplied, so the transit time variability is also a very important factor that needs to be considered when choosing mode of transport in multimodal transport.
- The fourth factor is security of product that is difficult to quantify so the author chose the fifth factor, which is transit time to become a third variable to apply the zero-one goal program modeling.

5.2.2 Weighting main factors

The optimization of shippers is minimizing the cost, minimizing the transit time and minimizing the transit time variable.

However, it is very difficult to identify which one is the most important, cost or transit time or transit time variable, because it depends on each enterprise with its' own strategy and its own available resources. This is the reason why the method "questionnaires" was chosen to ask Vietnamese enterprises to decide what the variables are, and the Analytic Hierarchy Process (AHP) method was used to specify the weight of each factor.

This model uses the judgment of the author combined with questionnaires to determine the ranking of criteria. (R.r Haas and O. Meixner, 2005). The rank will be arranged from 1 to 9 in which 1 is less important, 3 is moderate important, 5 is strongly important, 7 is very strongly important and 9 is extremely important, and 2, 4, 6, 8 are the compromises between the above.

Based on the result of the questionnaire, the cost is the most important factor, and it is three times as important as the transit time variable, and the transit time variable is twice as important as transit time, the cost is fourth times as important as transit time. After that, pairwise comparisons were used to set up a matrix as follows:

$$\begin{array}{c} \\ Cost \\ Transit\ time\ variable \\ Transit\ Time \end{array} \begin{array}{c} \begin{array}{ccc} Cost & Transit\ Time\ variable & Transit\ Time \end{array} \\ \begin{bmatrix} 1 & 3 & 4 \\ 1/3 & 1 & 2 \\ 1/4 & 1/2 & 1 \end{bmatrix} \end{array}$$

$$\begin{bmatrix} 1 & 3 & 4 \\ \frac{1}{3} & 1 & 2 \\ \frac{1}{4} & \frac{1}{2} & 1 \end{bmatrix} x \begin{bmatrix} 1 & 3 & 4 \\ \frac{1}{3} & 1 & 2 \\ \frac{1}{4} & \frac{1}{2} & 1 \end{bmatrix} = \begin{bmatrix} 2.9999 & 7 & 14 \\ 1.1666 & 2.9999 & 5.3332 \\ 0.66665 & 1.75 & 3 \end{bmatrix}$$

$$\begin{bmatrix} 2.9999 + & 7 + & 14 \\ 1.1666 + & 2.9999 + & 5.3332 \\ 0.66665 + & 1.75 + & 3 \end{bmatrix} = \begin{matrix} 23.9999 \\ 9.4997 \\ 5.41665 \end{matrix}$$

Sum = 38.91625

Normalizing the result:

$$\begin{bmatrix} \frac{23.9999}{38.91625} \\ \frac{9.4997}{38.91625} \\ \frac{5.41665}{38.91625} \end{bmatrix} = \begin{bmatrix} 0.6167 \\ 0.2441 \\ 0.1392 \end{bmatrix}$$

Continuing:

$$\begin{bmatrix} 2.9999 & 7 & 14 \\ 1.1666 & 2.9999 & 5.3332 \\ 0.66665 & 1.75 & 3 \end{bmatrix} x \begin{bmatrix} 2.9999 & 7 & 14 \\ 1.1666 & 2.9999 & 5.3332 \\ 0.66665 & 1.75 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 26.4987 & 66.4986 & 121.331 \\ 10.55474 & 26.4987 & 48.33107 \\ 6.041383 & 15.16638 & 27.6662 \end{bmatrix}$$

$$\begin{bmatrix} 26.4987 + & 66.4986 + & 121.331 \\ 10.55474 + & 26.4987 + & 48.33107 \\ 6.041383 + & 15.16638 + & 27.6662 \end{bmatrix} = \begin{bmatrix} 214.3283 \\ 85.38451 \\ 48.87396 \end{bmatrix}$$

Sum 348.5868

Normalize the result:

$$\begin{bmatrix} \frac{214.3283}{348.5868} \\ \frac{85.38451}{348.5868} \\ \frac{48.87396}{348.5868} \end{bmatrix} = \begin{bmatrix} 0.6148 \\ 0.2449 \\ 0.1402 \end{bmatrix}$$

As can be seen clearly that: $\begin{bmatrix} 0.6167 \\ 0.2441 \\ 0.1392 \end{bmatrix} - \begin{bmatrix} 0.6148 \\ 0.2449 \\ 0.1402 \end{bmatrix} = \begin{bmatrix} 0.0019 \\ -0.0008 \\ -0.0010 \end{bmatrix}$ there is not much difference between the two, so the author chose the weight for the factors as follow:

$W_{cost} = 0.6148 = W_1$

$W_{Transit\ time\ variable} = 0.2449 = W_2$

$W_{Transit\ time} = 0.1402 = W_3$

5.2.3 Scenario when applying zero-one goal programming model combining with integer liner programming

The purpose of applying this model was to find the most optimal route to transport one 20" container from Bangkok (Thailand) to Ho Chi Minh City (Vietnam). The optimal route is defined as a route with minimum total costs, minimum total transit time and minimum transit time variability.

There are still limitations, but the author has tried to convert some quality factors to make it more reasonable. For example, congestion in port, safety of cargoes, scheduling obstacles and other problems were considered as transit time variability.

Goal

$$F = W_1 d_1 + W_2 d_2 + W_3 d_3 \rightarrow \min \quad (1)$$

Constraints:

$$\sum_{m \in M} \sum_{n \in N} \sum_{l \in L} C_{mnl} x_{mnl} = d_1 \quad (2)$$

$$\sum_{m \in M} \sum_{n \in N} \sum_{l \in L} V_{mnl} x_{mnl} = d_2 \quad (3)$$

$$\sum_{m \in M} \sum_{n \in N} \sum_{l \in L} T_{mnl} x_{mnl} = d_3 \quad (4)$$

$$\sum_{n \in OL} \sum_{l \in K} x_{mnl} = 1 \qquad (m \in O) \quad (5)$$

$$\sum_{m \in LD} \quad \sum_{k \in K} \quad x_{mnl} = 1 \qquad (n \in D) \qquad (6)$$

$$x_{mhk} = \sum_{n \in N} \quad \sum_{t \in K} \quad x_{hnt} \qquad (h \neq m \neq n, h \in N - O) \qquad (7)$$

Explanation:

The goal is achieved when the sum of costs, transit time and transit time variability is minimized. This means finding three deviational variables that make the goal minimize.

- x_{mnl} is a binary variable, if link (m, n) carried by mode l is chosen then x = 1, if not, x will be 0.
- x_{mnl} is an integer variable
- d_1: deviational variable of total costs (USD)
- d_2: deviational variable of transit time variability (hours)
- d_3: deviational variable of transit time (hours)
- m: start nodes
- n: end nodes
- l: modes of transport
- O: origin node
- D: destination nodes
- OL nodes directly linked with the origin
- LD: nodes directly linked with the destination.

Parameters:

- W_1: weight of cost factor
- W_2: weight of transit time variablility
- W_3: weight of transit time
- C_{mnl}: cost that shippers have to pay from *m* to *n* by mode *l*
- V_{mnl}: transit time variable from *m* to *n* by mode *l*
- T_{mnl}: transit time from *m* to *n* by mode *l*

Constraints:

Formula (2): total cost is minimized

Formula (3): total transit time is minimized

Formula (4): total transit time variability is minimized

Formula (5): to ensure that the origin has only one outflow

Formula (6): to ensure that the destinations have only one inflow

Formula (7): to ensure that the inflows equal to the outflows for all connection nodes excepting the origin node and destination nodes.

Each program has its own drawback:

- The cost including freight, handling cost, customs procedure, inventory and insurance fee.
- There are a lot of land transport carriers that have a wide range, so the second assumption is that different carriers have the same price and service.
- The third assumption is the economic factor that has the same effect on the freight from the time data collected until this moment.
- Because cost, time and time variability are not in the same units, it was necessary to convert to another common unit by dividing each value with the max value in each column.

5.2.4 Cases of choosing modes and routes to transport cargoes

At 26th of November 1999, the agreement between and among the Governments of the Lao People's Democratic Republic, the Kingdom of Thailand, and the Socialist Republic of Vietnam for "Facilitation of Cross-border Transport of Goods and People" was signed. In the agreement the parties reduced time used for customs procedures such as exempting cargoes in international transit from routine customs

physical inspection at the border, customs escorts in the national territory and the deposit of a bond as a guarantee for the customs duties. (Vietnam, Laos, Thai, 1999)

According to the Agreement, the operators of each country can enter into the other two to deliver and pick up cargoes. Cargoes are transported from Thailand to Vietnam by road along the East West Economic Corridor, from Thailand via Savannakhet – Laos to Danang or Quy Nhon – Vietnam. This agreement will help reduce transport costs, and increase the amount of cargo imports and exports between the countries. At first there were 1200 vehicles, 400 from each country, licensed to enter the two neighbouring countries, and with some types of cargo that have low risk, they are allowed to clear fast at the border crossing. (Vovnews, 2009)

Vietnamese cargoes are holding a big market share of Cambodia, Cambodia is also a big market for Vietnam to transport to 3rd countries. The Cambodians really like cargoes from Vietnam, and they have many policies to attract more investment and promote import and export from and to Vietnam. In 2009, the import and export value had significantly grown at the Tinh Bien (An Giang) border. (Nguyễn, 2010)

Figure 5.2: Route Vietnam – Laos – Thailand

Source: Jetro Logistics Network Map.

For example: the cooperation among the three countries Thailand-Laos-Vietnam in transportation is the route Bangkok-Savanakhet-Ha Noi the distance, time for carrying cargoes and time at berth as well as cost are displayed in the table below:

Route	***Distance (km)***	***Time (hours)***	***Remark***
Bangkok – Mukdahan (road)	700	26	
Custom procedure at border point		3	1 hour for waiting at custom office
Savannakhet – Den Savan	250		
Transshipment		24	
Custom procedure at border point		1	
LaoBao – Ha noi	700	27	
Total	1650	81	

Table 5.6: Total distance and time from Bangkok to Ha Noi (Vietnam)

Source: Author, synthesized from many sources

Route	***Freight (per TEU)USD***	***Cost***	***Custom Clearance charge (USD)***
Bangkok – Mukdahan • Mukdahan	700		200
Savanakhet – Den Savan • Document fee • Transshipment fee • Custom clearance	250	200 100	200
Lao Bao – Hanoi • Custom clearance	700		200
Total	***2550***		

Table 5.7: Freight, cost and custom clearance charge when three countries cross borders of each other.

Source: Author, compiled from many sources.

The route between Bangkok and Hanoi has some advantages, but many disadvantages still exist. Laos is a land-locked country, so there is no way to take the advantages of water transport in terms of saving money and reducing cost used for

investing in infrastructure. The way to transport cargo depends much on the infrastructure system in Laos and neighbouring countries. However, the national road NH1 has high population where inter-city traffic and local traffic are mixed with each other. This leads to the limitation in speed when transporting cargo from the origin to other places to about 25km/h for vans and trucks.

Another obstacle on this route is the loss of time for formalities and procedures, complicated documents and limitations in operating hours at border gates. In spite of applying the "Facilitation of Cross-border Transport of Goods and People", carriers still need to present the original documents, which leads to loosing time and money.

5.4 Route number 1: from Laos to Singapore via Bangkok – Thailand or Quy Nhon – Vietnam.

Transport cost includes some elements:

Freight, in order to quote the freight for the customer, each company has to consider many costs related to their quotation such as fuel, crew cost, administration cost, charter rate, port charges, agency fee and other fees. The freight rate depends on the length of route, the time of economy, and the balance between demand and supply. This thesis is based on the freight rates of some carriers that hold big market shares on these routes.

According to "intermodal transportation cost modelling" and "modelling shipper costs", there are four types of cost: inventory costs (including: shipper inventory-holding cost, in-transit inventory holding cost, recipient inventory holding cost and safety stock), shipment holding costs, facility (warehouse and terminal) cost and indirect costs (administration, clerical, marketing and claims). (Higginson, 1993)

The storage cost, or perhaps better named, the inventory-holding cost, depends on where the warehouses are located. This is calculated as the product of the inventory holding cost parameters, the value of each item shipped and the transportation time. (Higginson, 1993)

The handling cost, depends on the ports that a vessel calls at. For example: Terminal handling charge (THC) of PSA is 182 SGD for a 20" container and 270 SGD for a 40" container. Phnom Penh and Sihanoukville apply THC of 70USD for a 20" container. Bangkok port charges THCM at the fee of 2600 baht for a 20" container. In addition, the tariff, documentation fees and other charges of 21 ports in 17 countries in Asia and the Pacific region including Vietnam were investigated by the Economic and Social Commission for Asia and the Pacific (ESCAP).

Transit time variable includes the delay time in port because of strikes or bad weather and so on.

Transit time depends on the characteristics of each route, for example the means of transport used, the distance between nodes and so on. It includes the loading, unloading and waiting time at the port. The estimated transit time is compiled in the following table:

✓ *Vientiane – Quy Nhon – Singapore (Road – Sea)*

Route	***Distance (km)***	***Time (hours)***
Vientiane (Laos) – Savannakhet (Laos)	469	24
Savannakhet (Laos) – Lao Bao (cross border point)	264	26
Lao Bao – Quy Nhon (Vietnam)	330	24
Quy Nhon – Singapore (including 24 hours feeder connection)	1910	120
Total	***2973***	***194***

Table 5.8: Route, distance and transport time in the route Vientiane – Quy Nhon – Singapore (Road – Sea)

Source: Author, compiled from many sources

Route	***Freight (per TEU)USD***	***Cost USD***	***Custom Clearance charge (USD)***
Vientiane (Laos) – Savannakhet (Laos) – Quy Nhon (Vietnam)	1100	50	100
Quy Nhon – Singapore (including 24 hours feeder connection) • Other charges	400	60 600	
Other cost • THC in Singapore • Other costs		 146 100	
Total	***2556***		

Table 5.9: Route, freight, cost and custom clearance charge in the route Vientiane – Quy Nhon – Singapore (Road – Sea)

Source: Author, compiled from many sources

✓ *Vientiane – Bangkok – Singapore (Road – Sea)*

Route	***Distance (km)***	***Time (hours)***
Vientiane (Laos) – Nong Khai (Thailand)	20	8.5
Nong Khai (Thailand) – Bangkok Port (Thailand)	650	16
Bangkok Port – Singapore	1542	110
Total	***2212***	***134.5***

Table 5.10: Route, distance and transport time in the route Vientiane – Bangkok – Singapore

Source: Author, compiled from many sources

Route	***Freight (per TEU)USD***	***Cost USD***	***Custom Clearance charge (USD)***
Vientiane (Laos) – Nong Khai (Thailand) • Document fee • Transit fee • Custom (Laos) • Custom (Thailand)	100	 55 70	 13 13
Nong Khai (Thailand) – Bangkok Port (Thailand) • THC	350	 86	
Bangkok Port – Singapore • THC • Other charges	230	 146 150	
Total	***1213***		

Table 5.11: Route, freight, cost and custom clearance charge in the route Vientiane – Bangkok – Singapore

Source: Author, compiled from many sources

✓ *Vientiane –Laem Chabang – Singapore (Road – Sea)*

Route	***Distance (km)***	***Time (hours)***
Vientiane (Laos) – Thanaleng (Thailand)	13	1
Thanaleng – Laem Chabang Port	719	24
Laem Chabang port • Handling cargo • Feeder connection		 24 24
Laem Chabang Port – Singapore	1470	96
Total	***2202***	***169***

Table 5.12: Route, distance and transport time in the route Vientiane – Laem Chabang – Singapore

Source: Author, compiled from many sources

Route	***Freight (per TEU)USD***	***Cost***	***Custom Clearance charge (USD)***
Vientiane (Laos) – Thanaleng (Thailand)	55		
Thanaleng – Laem Chabang Port • Document fee • Laos • Thai	365	55	 13 13
Laem Chabang port • Handling cargo • Other charges		86 150	
Laem Chabang Port – Singapore • THC • Other charges	200	 146 150	
Total	***1233***		

Table 5.13: Route, freight, cost and custom clearance charge in the route Vientiane – Laem Chabang – Singapore

Source: Author, compiled from many sources

✓ *Vientiane – Lat Krabang – Port Klang - Singapore (Road – Rail – Road)*

Route	***Distance (km)***	***Time (hours)***
Vientiane (Laos) – Thanaleng (Thailand)	13	1
Thanelang– Lat Krabang	580	45
Lat Krabang – Port Klang	1180	100
Port Klang – Singapore	407	34
Total	***2180***	***180***

Table 5.14: Route, distance and transport time in the route Vientiane – Lat Krabang – Port Klang

Source: Author, compiled from many sources

Route	***Freight (per TEU)USD***	***Cost***	***Custom Clearance charge (USD)***
Vientiane (Laos) – Thanaleng (Thailand)	55		
Thanaleng – Lat Krabang • Document fee • Laos • Thai • Transfer mode	400	 55 100	 13 13
Lat Krabang – Port Klang • At Lat Krabang	350	 200	
Port Klang – Singapore • Transfer mode at Singapore • Other charges	200	 100 150	
Total	***1636***		

Table 5.15: Route, freight, cost and custom clearance charge in the route Vientiane – Lat Krabang – Port Klang

Source: Author, compiled from many sources

Start node	***End node***	***Mode***	***Cost***	***Transit time***	***Transit time variable***
Vientiane	Thanelang	Road	55	1	0.166667
Vientiane	Nongkhai	Road	251	28.5	9
Thanelang	Laemchabang	Road	682	72	14
Thanelang	Lat Krabang	Rail	581	45	10
Nongkhai	Bangkok	Road	436	16	4
Bangkok	Singapore	Sea	526	120	17
Laeam Chabang	Singapore	Sea	496	96	15
Lat Krabang	Port Klang	Rail	550	100	17
Pork Klang	Singapore	Road	450	34	9
Vientiane	Quy Nhon	Road	1250	74	14
Quy Nhon	Singapore	Sea	1306	110	16.3333

Table 5.16: Cost, transit time and transit time variable of routes Vientiane-Singapore

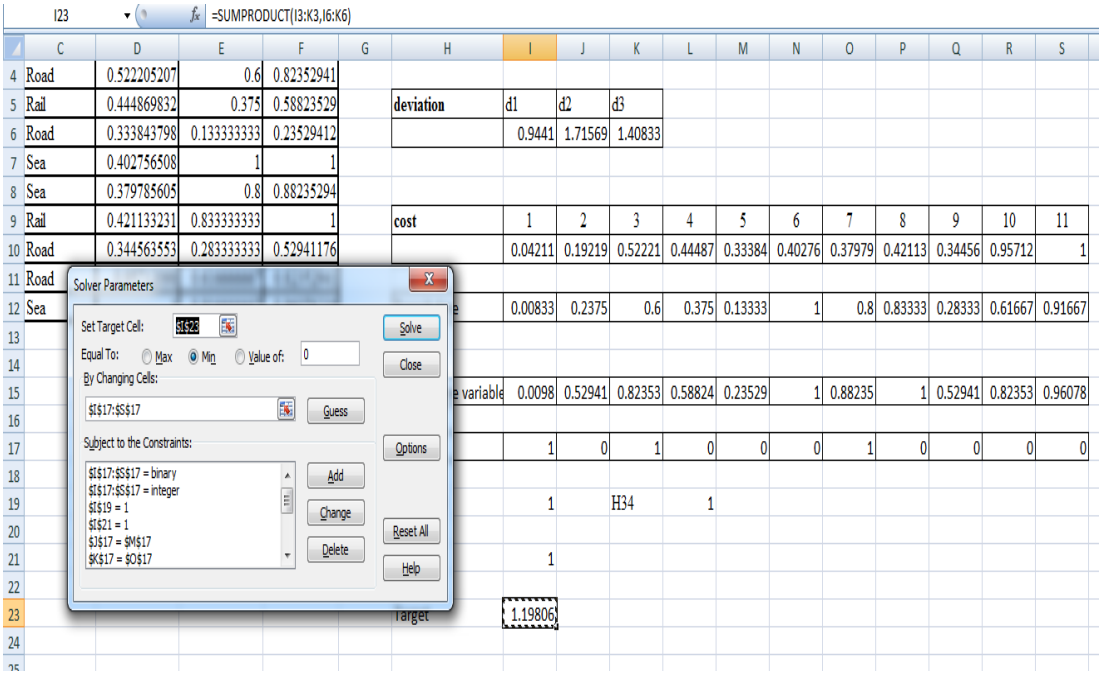
Source: Author, collected from various industrial sources.

Start node	***End node***	***Mode***	***Normalized Cost***	***Normalized Time (hours)***	***Normalized Transit time variablility***
Vientiane	Thanelang	Road	0.042113323	0.008333333	0.009803941
Vientiane	Nongkhai	Road	0.192189893	0.2375	0.529411765
Thanelang	Laemchabang	Road	0.522205207	0.6	0.823529412
Thanelang	Lat Krabang	Rail	0.444869832	0.375	0.588235294
Nongkhai	Bangkok	Road	0.333843798	0.133333333	0.235294118
Bangkok	Singapore		0.402756508	1	1
Laeam Chabang	Singapore	Sea	0.379785605	0.8	0.882352941
Lat Krabang	Port Klang	Rail	0.421133231	0.833333333	1
Pork Klang	Singapore	Road	0.344563553	0.283333333	0.529411765
Vientiane	Quy Nhon	Road	0.95712098	0.616666667	0.823529412
Quy Nhon	Singapore	Sea	1	0.916666667	0.960782353

Table 5.17: Normalized cost, transit time and transit time variable of routes Vientiane - Singapore

Source: Author's calculations.

Using solver 2007 in excel, the scene was:



After solving by using excel, the best route is Vientiane- Thanelang-Laem Chabang-Singapore (Road – Road – Sea) with the total cost being 1233 USD/container 20” of dry cargo, the total transit time variable is 29.16666 hours and the total transit time is 169 hours.

Number	***Route***	***Cost (USD)***	***Time (hours)***	***Variable time***	***Target***
1	*Vientiane – Quy Nhon – Singapore (Road – Sea)*	2556	30.3333	184	1.855189263
2	*Vientiane – Bangkok – Singapore (Road – Sea)*	1273	30	164.5	1.223632541
3	*Vientiane –Laem Chabang – Singapore (Road – Sea)*	1233	29.16666	169	1.19806
4	*Vientiane – Lat Krabang – Port Klang - Singapore (Road – Rail – Road)*	1636	36.16667	180	1.501460376

Table 5.18: Comparing four routes from Vientiane to Singapore

Source: author calculated

Comparing the cost, transit time and transit time variability, Thailand is more competitive than Vietnam, although at the Thanaleng border between Thailand, and Laos, the time used for custom clearance can be long and at the custom house pilferage can occur when the customs officers check the goods.

Route number 4 has a high cost, longer transit time and lower reliability because the ICD at Lat Krabang is the major ICD in Thailand, and always has traffic jams because the cargoes from and to Laem Chabang are loaded and discharged there up to 40%. Another reason is that Laeam Chabang wishes to save costs and due to the direct transport from Bangkok to Laem Chabang this causes traffic jams so Lat Krabang is chosen to reduce this. (State Railway of Thailand)

When transporting cargoes across Vietnam, the infrastructure is the biggest disadvantage since the main road on this route is under-qualified. Although the

freight is not a big problem in either road or sea transport compared to transport via other ports in Thailand, the cost paid for a container in transit in Quy Nhon is twice as high as in Bangkok. In addition, 6% of the total inland transport cost is spent at the border between Laos and Quy Nhon. The reliability of this route is very low, shippers sometimes have to wait for a long time before cargoes are loaded on to the vessel and transported to Singapore. Moreover, the Single Stop Service (SSS) and Single Window Service (SWS) are not fully implemented. The number of officials affects the time and cost of cargo trasitting.

According to Prof. Banomyong, the other charges that are indirectly involved in transportation represent nearly 50% of total cost that shippers have to pay. In order to reduce these costs, the cooperation between Laos and Vietnam should be promoted to a higher level, the imbalance in trade between the two be limited and more attention paid to “Green Logistics”.

According to Salakham (2007), “Laem Chabang's main objective to cater to domestic transportation requirement. Although Danang has the advantage of strategic location and shorter route, Laem Chabang is more competitive in terms of modern infrastructures, convenient domestic transportation systems and efficient port facilities. In 2006, only 37,000 TEU containers passed through Danang compared to Laem Chabang's volume of 4.1 million TEU containers. It will take a lot of capital and time before Vietnam, Laos and Burma can catch up” said Chalermkeat Salakham, Director General of Laem Chabang Port. (กองบรรณาธิการ, 2007)

Time is the difficult thing which needs to be reduced by implementing SWS and SSS quickly and homogenously, as well as applying more advanced technology in checking and monitoring cargoes.

Vietnam should care more for the human resources, by enhancing employees skills in logistics to reduce costs and attract more customers. Also, enterprises should use modern equipment to handle cargoes and encourage more investment in the infrastructure.

5.5 The case of transport cargoes in route Vietnam – Cambodia – Thailand

The case choice of routes between Thailand-Cambodia- Vietnam: applied to a 20" container.

Data collection:

There are not many carriers operating in this trade, but each carrier transports in different time and with different freight. The inland waterway freights of some main enterprises operating on the Phnom Penh-Ho Chi Minh City (HCMC) route are:

Name	***Freight (cont 20")***	***Time (hours)***
Gemadept	270	36
Hai Minh	240	40
Tan Cang Cypress	250	48
Average	253.333	40.333
Standard deviation	15.275	7.5055

Table 5.19: some shipping lines are operating in the route PhnomPenh- HCMC

Source: author complies from enterprises

Name	***Freight (cont 20")***	***Cost/cont***	***Time (hours) for tranportation***	***Total time***
K"Line	300	600	72	90
Vosco	300	600	73	95
Vinaline	320	620	73	95
NYK	300	600	72	92
Bien Dong	280	580	74	96
Average	300	600	72.8	93.6
Standard deviation	14.1421	12.65	0.8367	2.50998

Table 5.20: ocean freight, cost, transport time and total time from Bangkok to Vietnam

Source: author complies from enterprises

Number	*Start nodes*	*End nodes*	*Mode*	*Cost*	*Time*	*Variable*
1	Bangkok	Phnom Penh	Road	690	28	2
2	Bangkok	Phnom Penh	Rail	725	24	3
3	Bangkok	Sihanoukville	Sea	800	45	3
4	Bangkok	HCM	Sea	600	93.6	2.50998
5	Bangkok	HCM	Air	7500	4	0.5
6	Sihanoukville	Phnom Penh	Road	210	5	0.451
7	Sihanoukville	HCM	Sea	1000	48	3
8	Phnom Penh	HCM	Road	600	27	5
9	Phnom Penh	HCM	Inland wtw	253	40.333	7.5055
10	Phnom Penh	Sihanoukville	Road	210	5	0.451

Table 5.21: Cost, transit time and transit time variability of some routes between Bangkok and HCMC

Source: author complied from many industrial sources.

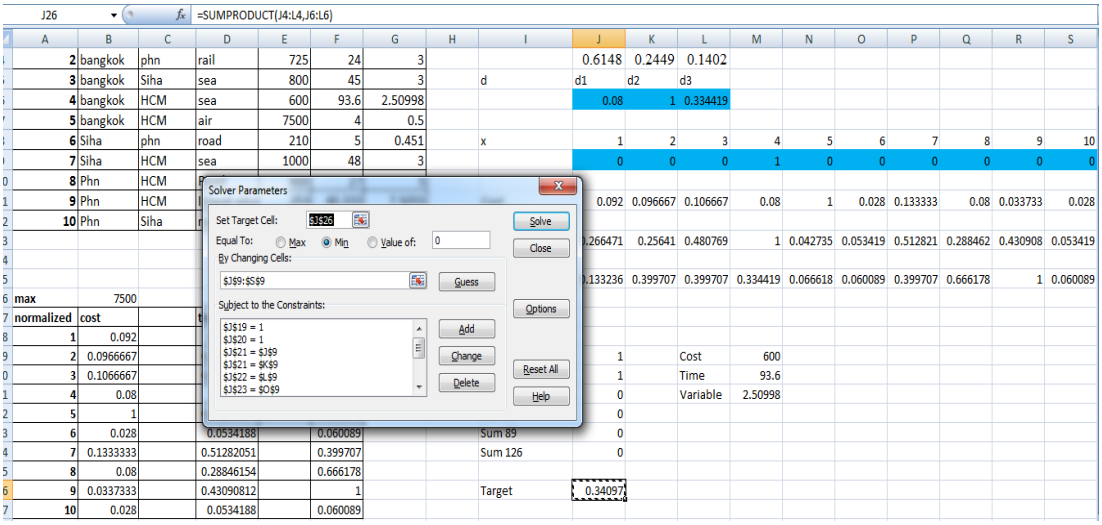
Number	*Start nodes*	*End nodes*	*Mode*	*Cost*	*Time*	*Variable*
1	Bangkok	Phnom Penh	Road	0.092	0.2991453	0.266471
2	Bangkok	Phnom Penh	Rail	0.0966667	0.25641026	0.399707
3	Bangkok	Sihanoukville	Sea	0.1066667	0.48076923	0.399707

4	Bangkok	HCM	Sea	0.08	1	0.334419
5	Bangkok	HCM	Air	1	0.04273504	0.066618
6	Sihanoukville	Phnom Penh	Road	0.028	0.0534188	0.060089
7	Sihanoukville	HCM	Sea	0.1333333	0.51282051	0.399707
8	Phnom Penh	HCM	Road	0.08	0.288462	0.666178
9	Phnom Penh	HCM	Inland wtw	0.0337333	0.43090812	1
10	Phnom Penh	Sihanoukville	Road	0.028	0.0534188	0.060089

Table 5.22: normalized cost, transit time and transit time variable.

Source: author calculated based on table 5.21

Data was entered into an excel file and solver was used to find the best choice of route.



Route number 4 from Bangkok to Ho Chi Minh City by sea was seen to be the best route with the normalized target is 0.34097, d_1= 0.08, d_2=1 and d_3=0.334419.

Number	***Route***	***Cost (USD)***	***Time (hours)***	***Variable time***	***Target***
1	Bangkok $\xrightarrow{Road}$ Phnom Penh Phnom Penh $\xrightarrow{Road}$ Ho Chi Minh city	1290	51.94171	6	0.353726
2	Bangkok $\xrightarrow{Road}$ Phnom Penh Phnom Penh $\xrightarrow{Inland\ \ waterway}$ HCMC	943	65.27471	8.5055	0.406969
3	Bangkok $\xrightarrow{Sea}$ Sihanoukville Sihanoukville $\xrightarrow{Sea}$ HCMC	1800	93	6	0.50296
4	Bangkok $\xrightarrow{Sea}$ Sihanouville Sihanouville $\xrightarrow{Road}$ Phnom Penh Phnompenh $\xrightarrow{Inland\ \ waterway}$ HCMC	1263	90.333	10.9565	0.544548
5	Bangkok $\xrightarrow{Air}$ HCMC	7500	4	0.55	0.634606

6	Bangkok $\xrightarrow{sea}$ Ho Chi Minh City	600	93.6	2.50998	0.34097
7	Bangkok $\xrightarrow{Rail}$ Phnom Penh Phnom Penh $\xrightarrow{Road}$ Ho Chi Minh City	1325	51	8	0.391491
8	Bangkok $\xrightarrow{Sea}$ Sihanouville Sihanouville $\xrightarrow{Road}$ Phnom Penh Phnompenh $\xrightarrow{Road}$ HCMC	1610	77	8.451	0.491306
9	Bangkok $\xrightarrow{Rail}$ Phnom Penh Phnom Penh $\xrightarrow{Inland\ waterway}$ HCMC	978	64.333	10.5055	0.444733
10	Bangkok $\xrightarrow{Rail}$ Phnom Penh Phnom Penh $\xrightarrow{Road}$ Sihanoukville Sihanouville $\xrightarrow{Sea}$ HCMC	1935	77	6.451	0.480588
11	Bangkok $\xrightarrow{Road}$ Phnom Penh Phnom Penh $\xrightarrow{Road}$ Sihanoukville Sihanouville $\xrightarrow{Sea}$ HCMC	1900	77.94171	4.451	0.442823

Table 5.23: Comparing routes between Bangkok and Ho Chi Minh City

Source: author calculated

There are many choices of routes and combinations of modes when transporting cargo from one node to another. With the developments in high technology and

information collected by shippers, excel with solver program can easily run and give results in just a few seconds. This program can be applied for more complex routes with many origin nodes and destinations as well as intermediate nodes.

The route from Bangkok to Ho Chi Minh City by sea was seen to be the best choice because it saves time and costs compared to other routes. In addition, the link between the two large markets makes it easy to have frequent services.

However, if there is the requirement to transit in Cambodia, route number 6, number 1 and number 7 will be the other good alternatives.

Route number 1 from Bangkok to Phnom Penh and from Phnom Penh to Ho Chi Minh City by road covers a total distance of nearly 950 km. However, the time for transport and transit at the border takes nearly as long as transporting by sea and the cost is more than twice as high. Most roads on this route are urban, so it is easy to be delayed by traffic jams in rush hours. One more bottleneck is the customs clearance, which takes too much time at the border and requires the unity of 3 countries to allow the trucks of each country to enter others without checking.

Route number 2 is a potential route because cargoes can follow the river in the South of Vietnam to Phnom Penh with little difficulty except the bottleneck at Cho Gao channel, which is narrow and where traffic jams occur regularly.

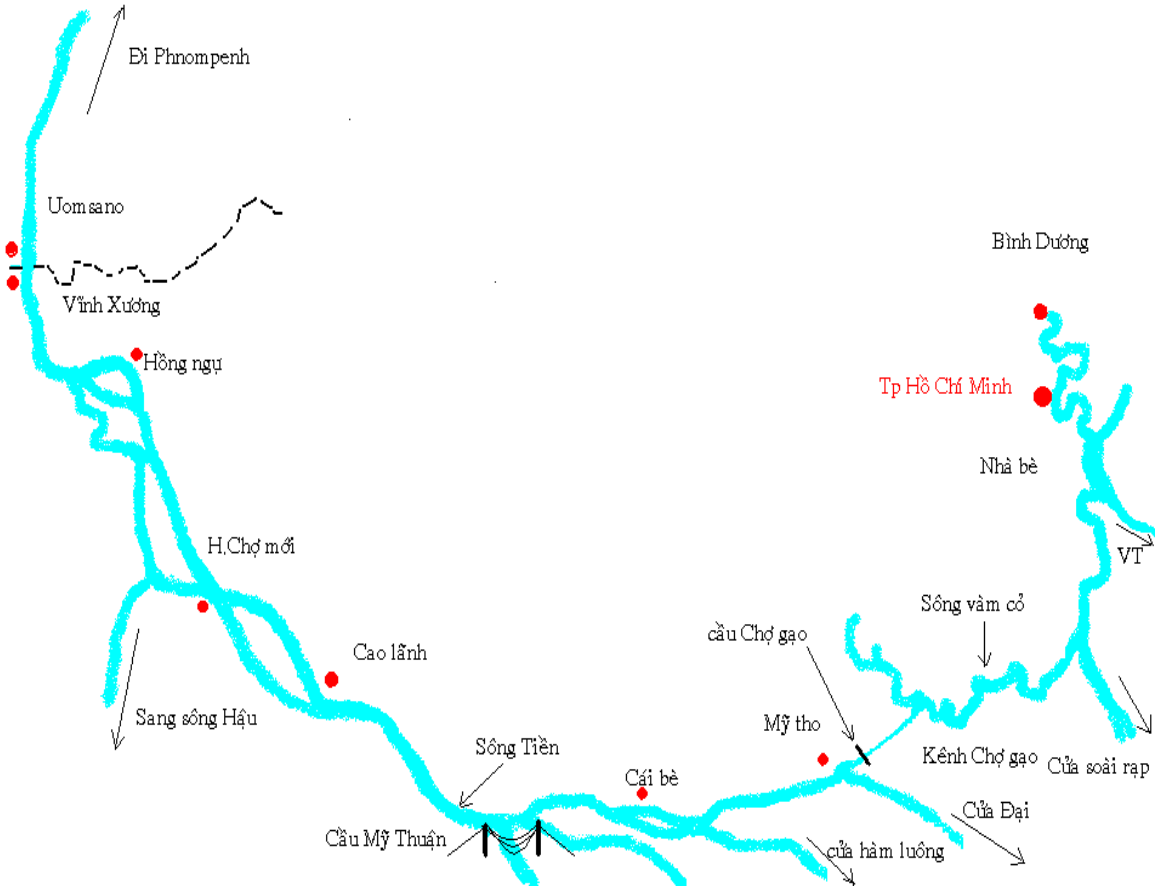


Figure 5.3: route from Ho Chi Minh City to Phnom Penh by inland waterway

Source: Gemadept corporation

Due to the limitation in draft of the route, the maximum size of vessel is 100 TEUS. Consequently, the capacity is not high enough to meet the requirements of the customers.

The other routes do not seem to be significantly operated because of the high cost, long transit time and low quality infrastructure to make the transportation process smooth.

In the future, if the missing link between Phnom Penh and Ho Chi Minh City is completed the transport time from Bangkok to Ho Chi Minh City can be reduced

significantly. However, it is said that this link will be difficult to be completed, since there is no incentive to build it and a lack of investment.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

This chapter has the purpose of summarizing all the tasks that the author has done. In addition, the author mentions the limitations of this dissertation. Furthermore some recommendations to improve these limitations are given. At the end of the chapter, some comments and recommendations for further research in the future are included.

6.1 Conclusion

Nowadays, logistics is becoming more and more popular. One way that helps this business succeed is paying attention to multimodal transport. However, choosing the best way to transport cargoes by using more than one means of transport is very complicated and requires Multimodal Transport Operators to consider many factors such as cost, time, route and so on. This research focuses on following matters:

There are many ways to choose the important elements affecting the choice of carriers. There are some studies that have researched this. However, different countries and different enterprises have different criteria. Therefore, in order to find the best criteria, it is necessary for this thesis to implement a survey that asks the people who are giving multimodal transport services in the country that the author wishes to analysis. The result of the survey has revealed that for Vietnamese enterprises, the cost, transit time, security of cargo and reliability are the most important aspects.

From that result, the thesis continues with the decision of which method to use to find the best means of transport to carry cargoes from one origin to the expected destination. The author chose to the methods of linear programming and non-linear

programming that were used by some authors in selecting modes for transporting cargoes. Consequently, the linear program with zero-one goal modeling was chosen in which the targets are based on the expectations of Vietnamese shippers. They are minimizing cost, transit time and transit time variables.

Two routes from Laos to Singapore via Vietnam or via Bangkok and from Bangkok to Ho Chi Minh City via Phnom Penh are chosen to illustrate how the model works. When the outcomes are known with the help of a solver program in Microsoft Excel, the thesis can answer these questions:

- Which modes of transport are selected?
- Which routes should multimodal transport operators choose?
- What are the potential alternative modes and routes?

Therefore, if the data of other routes are available even with more data and large samples, the zero-one goal modeling combined with the Analytic Hierarchy Process and solver program in Excel can be applied to choose the optimal solution to transport cargoes in as short time as possible.

This thesis also analyses the cooperation in multimodal transport among ASEAN countries. From that point of view, the benefits and the limitations of this cooperation can be recognized in some of the following aspects:

- ASEAN countries are located on the significant position that international maritime transport passes. The Port of Singapore, Port of Tanjung Pelapas and potential port of Cai Mep (Vietnam) are the deep sea ports where mother vessels can call and serve for the Asian market.
- ASEAN is a flexible region; the growth rates of member countries are high. They are reviewed as potential regions, and the cargoes transported from and to ASEAN are estimated to increase year by year.
- The differences of culture, economy and politics are important obstacles for cooperation among the member countries.

- The infrastructure of member countries is asynchronously developed. Some governments do not pay attention to, or do not invest in, infrastructure appropriately. Consequently, it is difficult to coordinate transport systems among the member countries.
- The ASEAN Framework Agreement on Multimodal Transport has been signed. However, the law systems of each country are totally different. There are some places where the procedures related to transporting cargoes among countries are very complicated. Shippers have to wait a long time to make cargo clearances and even the other cumbersome procedures are evident.

Although Vietnam has Cai Mep port and Van Phong port with deep drafts. However, in a research of Mr Nguyen Dang Ben (Vietnam) in recent years has estimated that cargo throughput of Vietnamese transshipment ports in 2015 are 10.946.253TEU (Cai Mep) and 2.100.000TEU (Van Phong) and in 2020 are 14.208.156TEU (Cai Mep) and 4.500.000TEU (Van Phong), it is still be very difficult for Vietnam to become a hub port in the future because of the fast development of Hong Kong port and Singapore port. (Nguyen, 2009). Therefore, in long term Vietnam needs more time and more investment in infrastructure and human resources as well as suitable strategy to develop logistics service. Moreover, the close relationship with ASEAN member states will help Vietnam have good trade within region together with other regions in the world.

Countries	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*
Brunei	639.5	774.8	684.2	632.9	865	1529	1887.3	2149.5	1,972.9	1229.3
Cambodia	76	72.6	91.9	101.5	80.2	144.5	235.4	251.4	310.6	644.6
Indonesia	10883.7	9507.1	9933.5	10725.4	12994.3	15823.7	18483.1	22291.2	27,170.8	24623.9
Laos	-	-	-	102.2	89.6	147.6	289.8	257.4	724.4	997.4
Malaysia	24408.6	21024.2	22127.1	26036.2	31737.2	36633.7	40979.6	45295.6	50,401.4	40365.1
Myanmar	393.5	951.3	1221.3	3060.2	996.8	1559.7	2149.7	3427.7	3,853.4	3196.7
Philippinnes	5982.6	4986	5529.7	6581.7	6837.9	7149.9	8192.2	8031.9	7,081.7	5838.4
Singapore	37784	32815.4	33962.6	51777.8	62494.4	71976.4	83801.6	95003.5	101,477.3	81646.5
Thailand	13312.2	12549.4	13156.4	16583	21710	23867	26944.2	32894.2	39,487.0	32490.6
Vietnam	-	-	-	-	3850.9	5039.9	6214	7730.8	10,017.8	8554.8

Table 6.1: Intra ASEAN Export

Source: Author, compiled from ASEAN statistics

Countries	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*
Brunei	534.4	544.8	627.5	616.9	644.5	738.5	745.8	1043.3	1,571.4	1242.8
Cambodia	549.1	1091.7	598	1694.9	673.5	1026.8	991.2	1283	1,599.3	1453.3
Indonesia	6781.2	5726.8	6995.5	8030.3	11686	17329.5	19379.2	23792.1	40,991.7	27742.4
Laos	-	-	-	252.7	365.1	362.4	500.7	576.5	1,490.9	1480.8
Malaysia	15934.8	15254.3	17245.2	21003.1	26191.1	29164	32290.7	37315.9	34,675.3	31700.2
Myanmar	1113.3	1319.2	1190.8	967.8	951.1	896.6	1174.7	1413.1	1,728.2	2065.7
Philippinnes	4955.4	4664.8	5542	6398.1	8355.9	8874.3	10218.3	12875.1	14,316.7	11561.1
Singapore	33291.3	28991	30441.4	39550.5	47184.2	52148.6	62300.4	65850.2	69,878.1	59047.6
Thailand	10306.4	10047	10561.7	12616.3	15834.6	21552.4	23539.8	24992.5	29,888.2	26759.5
Vietnam	-	-	-	-	7695.3	8937.7	12453.7	15444.5	19,476.8	13566.7

Table 6.2: Intra ASEAN Import

Source: Author, compiled from ASEAN statistics

Limitation of the thesis

The survey is limited in the number of people, only 51 logistic providers, forwarders and shippers have been interviewed, while there are hundreds of enterprises involved in multimodal transport services.

In addition, it does not exactly reflect the real situation if just only cost, time and time variables are chosen to weigh and analyze the selected routes. There are still many factors that need to be considered, for example customer relationship, the level of global coverage of service, procedure processing time and so on.

The data collected are not sufficient because there are many carriers operating on these routes. The transit time and transit time variability is based on some main carriers due to the lack of information, and it is difficult to collect the data from all carriers.

Another limitation of the research is the choice of routes to analyze from Laos to Singapore and from Bangkok to Vietnam. These are short trips and they are not significantly affected by pirates, bad weather or other factors that a long trip can easily meet when navigating. As a result, the general scenario cannot be expressed clearly and it is difficult to apply to longer routes.

Another limitation of this thesis is that it only concentrated on the economic aspect. However, the environmental aspect and the influence of many other factors were not mentioned while in the world today, besides the purpose of enterprises is maximizing the profit, the environmental and welfare are also very important and should be concerned.

Finally, the methods which are used to calculate the weight of factors and solver program, especially establishing the constraints of each route in chapter 5 are complicated, difficult and take much time. The users need to use excel frequently and proficiency

6.2 Recommendation

Further research can be implemented for other routes which have a longer distance and take a longer time, not only transporting via Vietnam but also via other member States of the Association of Southeast Nations.

Other research can be conducted but in a larger scale, for example, choosing modes to transport cargo from one ASEAN country via deep sea ports such as Cai Mep Port (Vietnam) or the Port of Singapore to other continents like Europe, the Americas or Africa.

When implementing different research, the matter that should be concerned is that each type of transport will be suitable for specific type of cargo in terms of volume and value. Moreover, each type of mode is also suitable to each type of service and the distance of transportation. The table below gives a suggestion of the good mode to choose for the carriers as well as shippers.

Mode	Value	Volume	Service	Distance
Truck	Moderate to high	Loads of less than 50,000 lbs.	On-time performance above 90%.	Driver can go 500 miles per day. 2/3 of tonnage carried over less than 100 miles.
Rail	Moderate to low	Multiple car loads. No weight restrictions.	4 to 7 days delivery time. 60 to 85% on-time performance.	Average haul length between 600 and 800 miles.
Intermodal	Moderate to high	No weight restrictions.	3 days for cross country. On-time performance between truck and rail.	Average haul between 700 and 1,500 miles.
Air	High	Small. Most loads less than 100 lbs.	Normally overnight or second day.	More than 1,300 miles.
Inland Water	Moderate to low	Bulk shipments.	Varies according to segment. Competitive with rail.	Between 250 and 1,600 miles.
Coastal Water	Moderate to low	Containers, general freight and bulk shipments.	Function of distance. Between 2 to 5 days.	Between 500 and 2,000 miles.
International Water	High to low	Mainly containers and bulk shipments.	7 to 10 days trans-Atlantic and trans-Pacific routes.	More than 2,600 miles.
Pipeline	Low	Bulk shipment of liquids and gazes.	According to demand. 0 to 20 mph.	825 miles average distance for crude oil.

Table 6.3: the relationship between mode and cargo, distance and service

Source: US-DOT, FHA (1998) US Freight: Economy in motion. http://ntl.bts.gov/data/freightus98.pdf

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Appendix 1 – Questionnaire

QUESTIONAIRE TO MULTIMODAL TRANSPORT

Could you please to anticipate the necessary level of following factors when choosing modes of transport in multimodal transport in Vietnam?

Please ranking by typing "x" in the cell that you choose.

The scale of factors is ranked from 1 to 4:
1: very necessary
2: fairy necessary
3: quite necessary
4: unnecessary

	RANK			
	1	***2***	***3***	***4***
I. Cargo related factors				
□ Value				
□ Volume and measurement				
□ Weight				

□	Weight/measurement				
□	Packing				
□	Specialized goods :dangerous, fragile, perishable				
		RANK			
	II. Service related factors	**1**	**2**	**3**	**4**
□	Transit time				
□	Cost				
□	Reliability and punctuality				
□	Customer relationship				
□	Frequency				
□	Global coverage				
□	Procedure processing time				
□	Handling equipment arrangement				
□	Legal documentation				
□	Secure of product				

□	Electronic Data Interchange				
□	Flexibility of modes of transport				
		RANK			
	III. Company's strategy	**1**	**2**	**3**	**4**
□	Marketing strategy				
□	System of modal evaluation				
□	Management structure				
□	The size of company				
□	Capital of company	7	19	19	6
□	Investment policy	12	21	13	5
		RANK			
	IV. Other factors	**1**	**2**	**3**	**4**
□	Transport distance				
□	Destination area				
□	Delivery terms in contract				

□	Environmental issues				
□	Infrastructure of Vietnam				
□	Regulation of Vietnam and other countries				
		RANK			
	IV. Other factors	***1***	***2***	***3***	***4***
□	Facilities and ability of shipper's warehouse				
□	Communication and information				

Yes ***No***

Do you suggest any more factor? (Bạn có đề nghị thêm yếu tố nào nữa không?)
What is it?

Thank You Very Much For Helping Me Finish My Dissertation

Appendix 2 – ASEAN highway network map

6th ASEAN Highways Sub-Working Group Meeting
7-8 August 2003, Bangkok, Thailand

Figure 4.5: ASEAN highway route number (mainland)

6th ASEAN Highways Sub-Working Group Meeting
7-8 August 2003, Bangkok, Thailand

Figure 4.6: ASEAN highway route number (Island)