

Development of Trade Facilitation Indices to Compare International Ports in Thailand

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Abstract: This manuscript shows the development of trade facilitation indices for both imports and exports at seven international ports in Thailand by applying the Analytic Hierarchy Process (AHP) the results of questionnaires from freight forwarders. The indices consist of four elements: port infrastructure; port management; customs procedures; and equity in customs law enforcement. The data from 42 major freight forwarder companies were used to analyze their satisfaction about port services and customs operations, as well as to calculate indices' subcomponent weights. The indices show that most ports just passed their existing expectation and need improvements to facilitate future demand according to ASEAN Economic Community (AEC) in 2015. Next, future scenarios indices for predicting how ports can facilitate trade according to port and customs development plan and AEC scenarios were estimated. These indices can point out components that would be improved and lead to suggestions for port development for better trade facilitation.

Keywords: Trade Facilitation; Analytic Hierarchy Process; Port Management; Customs Operations; Maritime Transport; ASEAN Economic Community

1. INTRODUCTION

Since Thailand is a member of ASEAN agreement to be a part of ASEAN Economic Community (AEC) by 2015, the country has been adapted for incoming changes and must prepare port infrastructure and management to operate more efficiently.

Thailand's economy has depended on international trade. Fig. 1 shows the export and import trade values. It shows that trade values have increased almost ten times from 1992 to 2011

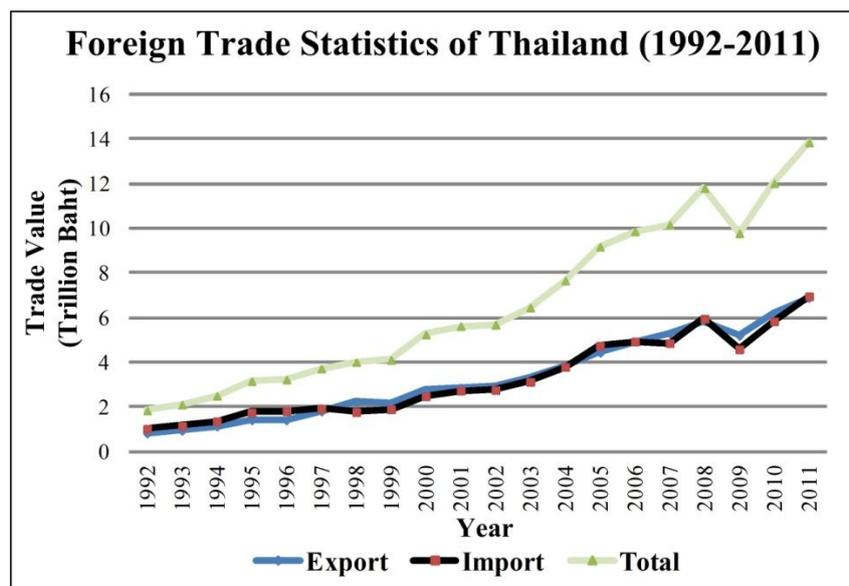


Figure 1. Foreign Trade Statistics of Thailand 1992-2011 (Ministry of Commerce of Thailand, 2012: online)

Maritime transportation plays an important role to Thailand’s trade, i.e., about 80% of all export and import volumes are transported by sea. Evidently, Fig. 2 shows the volumes of imported and exported goods separated by transport modes, i.e., blue, red, green, purple and yellow shades represent sea, road, rail, air, and others, respectively.

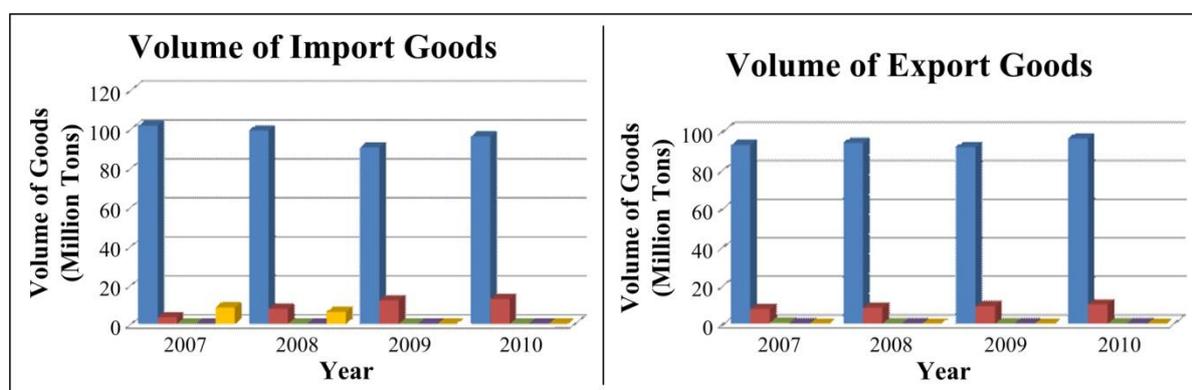


Figure 2. Volume of Import Goods (Left) and Export Goods (Right) (Ministry of Transport, 2012: online)

A port is a nodal infrastructure for international transportation. Transport and logistics related activities, customs regulations and checking procedures occur at the port. These are called “trade facilitation” in this study context, which we are concerned about the reduction of complicate steps especially for customs processes and harmonization to reduce transportation time and costs at ports.

Past literature has studied only some particular aspects of port. For examples, Suwanpanu (2005) and Sukdanont, *et al.* (2009) focus only on customs procedures and infrastructure usage, respectively. This study herein has developed trade facilitation indices (export and import indices) for Thailand’s international ports as a tool for evaluating port’s trade facilitation. In addition, they can be used for comparison among themselves, among different time periods once any development plan was implemented. They can also assist policymakers to improve trade facilitation at the ports according to the AEC.

2. LITERATURE REVIEW

2.1 Trade Facilitation

The term of “Trade facilitation” was defined by several organizations in similar meaning and scopes. Suwanpanu (2005) collected the definition from many sources: WTO defined it as the reduction of complicate steps and harmonization of transport and trade activities, which include customs process and trade information sharing. United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP, 2012: online) defines it as the promotion of simplification, harmonization, and standardization of trade procedures to reduce the cost as well as the time of the transactions. However, this paper will study “trade facilitation at international port” meaning that we are only concerned about the reduction of complicate steps especially for customs processes and harmonization to reduce transportation time and costs at ports.

2.2 Components for Port Transportation

Four components for port transportation are goods, infrastructure, stakeholders, and goods transportation procedures. The details for each component are as follows.

2.2.1 Goods

Types of goods lead to the selection of ports for shipment. Generally, sea transport goods can be divided into four types, i.e., bulk cargos, general cargos, liquid cargos and container cargos.

2.2.2 Port Infrastructure

Port infrastructure includes all port buildings involving goods transport activities as well as the connection between the port and transport modes of goods (either by rail, by road, or by coast). Fig. 3 shows the general layout of ports in Thailand. The first one is the transport way to the port (mostly by road). The second is the main gate for weight check and fee payment. The third is the sub gate for customs check. The last is the seaport berth and container yard area. For small ports, main gate and sub gate might be combined.

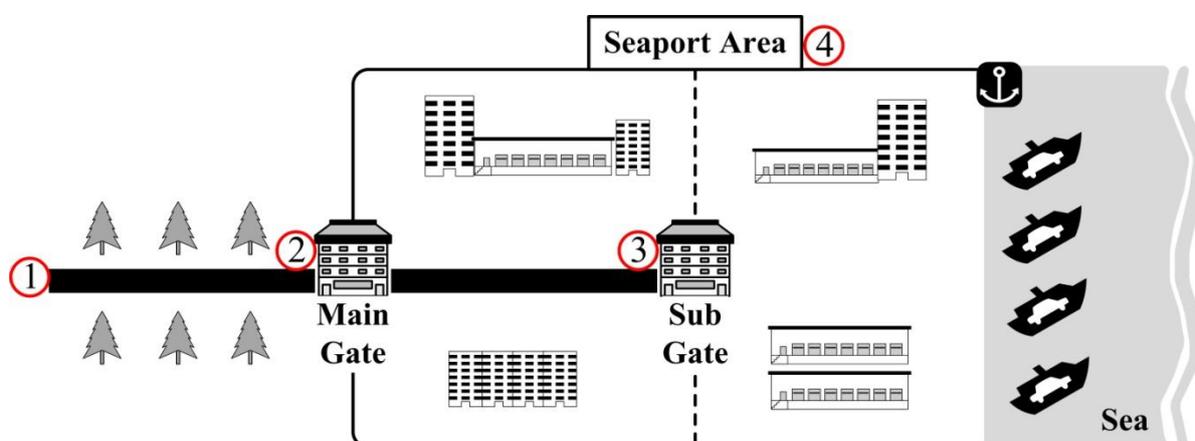


Figure 3. Port Infrastructure

2.2.3 Stakeholders

Persons involved in sea transportation can be divided into three parties. The first group is the exporter and importer party, which is considered to be main port customers who induce goods shipment. The second group is the transport and logistics operators managing the shipment for importers and exporters. These include custom brokers, ship agents, freight forwarders, and logistics providers. The last group is the regulators and port operators who control goods movements according to customs and transport laws. They are Marine Department, Customs Department, Port Authority of Thailand (PAT), Treasury Department, Industrial Estate Authority of Thailand, and private companies who own ports.

2.2.4 Goods Transportation Procedures

Fig. 4 shows general procedures for importing goods at a port. For full-container-load (FCL) shipment, once ship arrives, FCL containers are brought to a container yard. After that, customs brokers will pay customs tax and other fees. Sometimes in case of Red Line, high risk or sensitive shipment according to Customs designation, customs staff might check the container by either X-ray machines or opening it. On the other hand, for Green Line, or less risk/less sensitive shipment, goods could be brought out of the sub gate after paying customs fee. At the sub gate, paperwork will be handed to the drivers for submitting at the main gate. For less-than-container-load (LCL) shipment, the LCL container will be brought out of the sub gate and stored at the container freight station. Once the customs broker submits the paperwork and pays custom tax. Goods can be brought out of the main gate and the container will be stored at the container freight station.

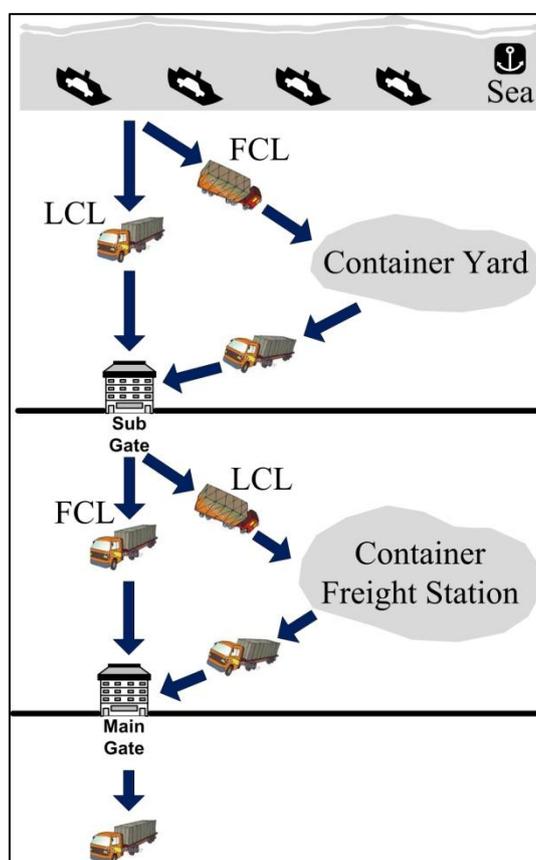


Figure 4. Procedure for Importing Goods

Fig. 5 shows general procedures for exporting goods at a port. For full-container-load (FCL) shipment, the exporters (or customs brokers) need to key in the shipment information online to e-customs website before a truck with the shipment can travel to the port. At the port's main gate, the truck is weighed and the port and tariff fees are paid. Afterward, the FCL containers will be checked at the sub gate to determine whether it is a high or low risk shipment (Red or Green Line). In the case of red line, the container will be X-rayed or manually checked until it is approved. After that it will be stored at the berth yard area for being lifted to a ship.

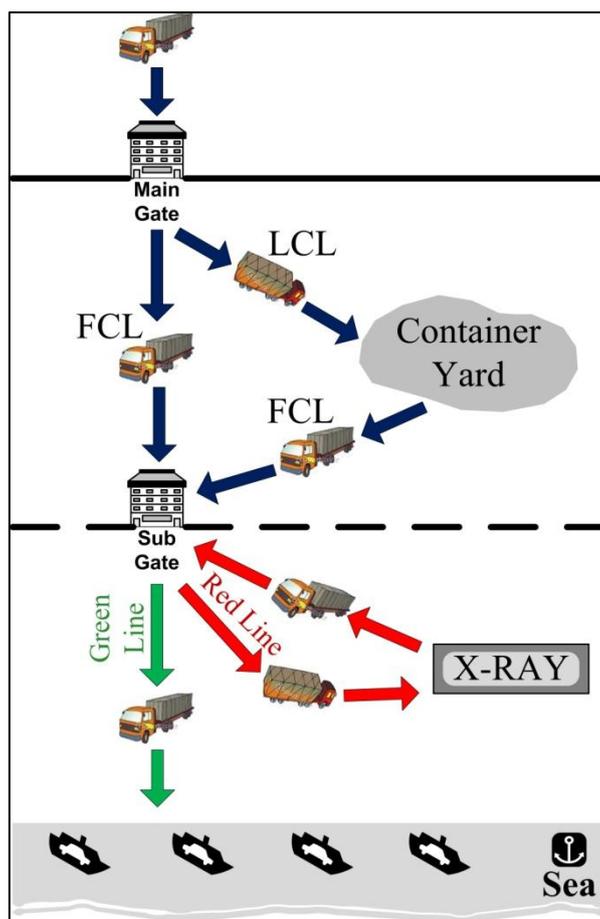


Figure 5. Procedure for Exporting Goods

It is noted that any container that is determined by the customs to be manually checked must be opened with four parties: port operator, ship operator, goods owner, and customs official.

2.3 AEC Plan for Improving Transport Facilitation

There are four plans according to AEC regarding the sea transport as follows.

2.3.1 Roadmap for an ASEAN Community 2009-2015

This road map covers four broad objectives, i.e., 1) an ASEAN single market and production base; 2) a highly competitive economic region; 3) a region of equitable economic

development; and 4) a region fully integrated into the global economy.

The implementation plans that might affect sea transportation are elimination of tariffs, elimination of non-tariffs barriers, rules of origin, trade facilitation, customs integration, ASEAN Single Window, and the implementation according to International Maritime Organization (IMO) and the Roadmap towards an Integrated and Competitive Maritime Transport in ASEAN (The Association of Southeast Asian Nations, 2009)

2.3.2 Master Plan on ASEAN Connectivity

This master plan promotes the connectivity among ASEAN countries and trading partners to support trade, investment, tourism and narrow the development gap within the region. The plans involved sea transport are improvement of water transport network efficiency, strengthening of world's sea routes connecting the region, and feasibility study of ASEAN navigation system network. (The Association of Southeast Asian Nations, 2011)

2.3.3 ASEAN Strategic Transport Plan 2011-2015 (ASTP 2011-2015) or Brunei Action Plan

Brunei Action Plan on water transport has main objectives to establish an integrated, competitive and seamless maritime transport network, paying explicit attention to promote maritime safety and security, and environment and user-friendly ports. Three objectives are 1) Accomplish an integrated, efficient, and competitive maritime transport system; 2) Develop safety navigation system and establish advanced maritime security system in line with international standards; and 3) Accomplish the Eco-Port and environmental-friendly shipping. (The Association of Southeast Asian Nations, 2010)

2.3.4 Roadmap towards an Integrated and Competitive Maritime Transport in ASEAN

This roadmap has a main objective to promote the progressive liberalization of maritime transport services in ASEAN and to develop ASEAN as a single market and production base. (The Association of Southeast Asian Nations, 2007)

2.4 Index Development by Analytic Hierarchy Process (AHP)

2.4.1 Trade Facilitation Index

University of the Thai Chamber of Commerce (2006) developed a "Trade Facilitation Index" for evaluating the overview of Thailand's trade facilitation by quantitative index. This index was created by using a questionnaire to stakeholders. Then, the survey data were analyzed by using diffusion index – interpreting the efficiency ranking into scores from 0=low, 0.5=medium, and 1=high. Afterward, the index can be calculated by Equation 1 below.

$$\text{Index} = \% \text{High} + 0.5(\% \text{Medium}) \quad (1)$$

For Equation (1), the maximum score could be achieved if all checked items are "high". Therefore, the closer index score to 100%, higher efficiency of trade facilitation can be interpreted. In this study herein, we also used diffusion index but ranged from 1 to 4 instead. The details of index will be presented in Section 3.

2.4.2 Analysis Hierarchy Process (AHP)

Saaty (1980) developed the Analytic Hierarchy Process (AHP) to be a tool for decision making process. Four steps in AHP are 1) determine the problem; 2) draw the hierarchy diagram by setting goal, component, and alternatives as shown in Fig. 6; 3) Use comparison matrix for pair-wise comparison; and 4) calculate eigenvector and priority vector for important scores. The importance scores must be checked for consistency by using the consistency ratio (CR), and if the CR is lower than or equal 10%, the respective comparison matrix is acceptable.

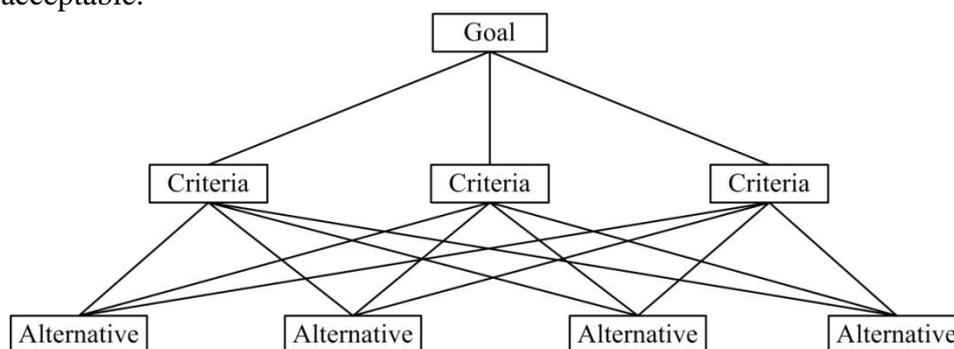


Figure 6. Structure of Analytic Hierarchy Process

Note that CR is the ratio of consistency index (CI) to random consistency index (RI), where CI can be calculated in Equation 2 and RI can be determined from Table 1. More explanation of AHP and RI can be found in Saaty (1980).

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{2}$$

Where λ_{max} = maximum eigenvalue in the comparison matrix,
 n = size of comparison matrix.

Table 1. Random Consistency Index by Saaty (1980)

n	1	2	3	4	5
RI	0	0	0.58	0.90	1.12
n	6	7	8	9	10
RI	1.24	1.32	1.41	1.45	1.49

2.5 Past Literature on Port Index

There have been a few studies creating port index to evaluate port efficiency. Clark, *et al.* (2004) studied the factors affecting sea transport cost, import volumes and characteristics from U.S. Import Waterborne Databank by using index and found that factors affecting transport costs are distance between trading partners, transport insurance, backhaul problem, coastal and port geography. This also pointed out how to import U.S. port efficiently. The Faculty of Economics, Chulalongkorn University (2011) studied the effects of trade facilitation at Bangkok Port and Laemchabang Port in Thailand by in-depth interviews of port operators, customs officers and exporters. This study also created the port efficiency index to compare among port operators in different timeline. However, it covers only two ports and did not consider the effect from the AEC.

Although there are several indices developed for evaluate trade facilitation, these indices are in macro-context. They developed for either country-level or regional-level comparison (see Yeo *et al* (2008) or Hoffmann (2009)), not for port level.

3. METHODOLOGY

Seven multi-user ports selected in this study are the most important ports in terms of high transport volumes in the central and eastern regions of Thailand. These are Bangkok Port (BKP), Laemchabang Port (LCP), Thai Prosperity Terminal (TPT), BMT Pacific (BMTP), Unithai Container (UTCT), Kerry Siam Seaport (KSSP), and Sriracha Harbour (SHB). In Jan-Feb 2012, through the assistance of Thai International Freight Forwarders Association (TIFFA), the questionnaires were submitted to all freight forwarder companies in central Thailand and 42 companies (25% of total) returned the questionnaires.

In the questionnaire, we asked them to determine important scores for each subcomponent involving trade facilitation at the ports (shown in Table 2). These subcomponents were mainly derived from previous port studies (Sumalee *et al* (2009), Yeo *et al* (2008), and Faculty of Economics, Chulalongkorn University (2011)) and from in-depth interviews of freight forwarders. These important scores will be used for weighing the subcomponents in the final index by using AHP as described in Section 2.4. Also, they were asked to evaluate each subcomponent, for imports and exports separately, by giving a score from 1= Very unsatisfied to 5 = Very satisfied.

Table 2. List of Component and Subcomponents

Component	Subcomponent
1. Infrastructure	Yard storage area
	Berth length
	Highway access
	Coastal and rail access
2. Port management (by port operator)	Port labor skill
	Safety
	Handling capacity
	Traffic management
3. Customs process (by Customs Dept.)	Customs officer's skill
	Paperwork system
	Customs efficiency
	Port coordination
4. Equity in customs law enforcement	-

Note that the “coastal and rail access” subcomponent score for each port was determined by the sum of two scores in Table 3. These criteria were developed to emphasize the importance of alternative modes for transporting goods to the port besides road transportation.

Table 3. Criteria to determine coastal and rail access score

Component	Score	Description
Coastal shipment to port	3	Have coastal transport service with coastal dedicated port
	2	Have coastal transport service without coastal dedicated port
	1	No coastal transport service
Rail shipment to port	2	Can efficiently access by rail
	1	Rail access with insufficient, restricted capacity

4. RESULTS

4.1 Weights of Components And Subcomponents

By AHP, weights of components and subcomponents for imports and exports can be calculated. They are shown in Tables 4 and 5 for imports and exports, respectively.

Table 4. Weights of subcomponents in case of imports

Component	Subcomponent
1. Infrastructure (21.9%)	Yard storage area (32.4%)
	Berth length (20.2%)
	Highway access (21.5%)
	Coastal and rail access (25.9%)
2. Port management (26.3%)	Port labor skill (24.8%)
	Safety (23.3%)
	Handling capacity (30.5%)
	Traffic management (21.4%)
3. Customs process (29.9%)	Customs officer's skill (24.2%)
	Paperwork system (28.1%)
	Customs efficiency (27.5%)
	Port coordination (20.2%)
4. Equity in customs law enforcement (21.8%)	-

Table 5. Weights of subcomponents in case of exports

Component	Subcomponent
1. Infrastructure (23.8%)	Yard storage area (32.2%)
	Berth length (20.5%)
	Highway access (22.7%)
	Coastal and rail access (24.6%)
2. Port management (29.1%)	Port labor skill (22.7%)
	Safety (23.5%)
	Handling capacity (30.8%)
	Traffic management (23.1%)
3. Customs process (25.1%)	Customs officer's skill (24.1%)
	Paperwork system (29.1%)
	Customs efficiency (28.3%)
	Port coordination (18.5%)
4. Equity in customs law enforcement (22.0%)	-

Tables 4 and 5 show that the highest weight of port's trade facilitation for imports is customs process since Thai customs concentrates much more on import goods check but exports rely more on port management since export goods are less checked from customs officers nowadays. For both, the highest weights among infrastructure, port management, customs process subcomponents go to yard storage area, handling capacity, and paperwork system, respectively.

4.2 Current Port's Trade Facilitation Index

Tables 6 and 7 show port's trade facilitation indices for imports and exports, respectively. The numbers of survey respondents for each port are varied due to different port size. Note that LCP, the largest port in Thailand, have the highest rank and the lower ranks go to BKP (old port), and private ports such as KSSP and SHB. Nevertheless, indices fall in the range between 2.51 to 3.50, considered to be neutral according to freight forwarders' opinions.

Table 6. Weights of subcomponents in case of imports

Component (weight)	Subcomponent (weight)	Average scores for each port						
		BKP	LCP	TPT	BMTP	UTCT	KSSP	SHB
1. Infrastructure (21.9%)	Yard storage area (32.4%)	2.76	3.58	3.18	3.36	3.00	3.00	2
	Berth length (20.2%)	2.59	3.61	2.95	3.27	3.20	3.20	2
	Highway access (21.5%)	2.39	3.47	2.95	3.09	3.00	2.40	1
	Coastal and rail access (25.9%)	4	3	1	2	3	1	1
2. Port management (26.3%)	Port labor skill (24.8%)	2.76	3.58	3.23	3.55	3.00	3.40	2
	Safety (23.3%)	2.54	3.61	3.14	3.27	2.80	2.80	2
	Handling capacity (30.5%)	2.85	3.45	3.27	3.73	3.40	3.40	4
	Traffic management (21.4%)	2.24	3.24	3.00	3.82	3.00	2.40	3
3. Customs process (29.9%)	Customs officer's skill(24.2%)	3.20	3.45	3.32	3.55	3.40	3.20	3
	Paperwork system (28.1%)	3.22	3.63	3.36	3.73	3.40	3.20	4
	Customs efficiency (27.5%)	3.05	3.45	3.23	3.55	3.20	3.20	4
	Port coordination (20.2%)	3.22	3.45	3.36	3.55	3.40	3.20	3
4. Equity in customs law enforcement (21.8%)		3.05	3.37	3.23	3.45	3.60	3.20	4
No. of freight forwarder respondents		41	38	22	11	5	5	1
Port's Trade Facilitation Index		2.95	3.44	3.07	3.41	3.25	2.97	3.01

Note: Very satisfied (>4.50), Satisfied (3.51-4.50), Neutral (2.51-3.50), Unsatisfied (1.51-2.50), Very unsatisfied (\leq 1.50); BKP=Bangkok Port, LCP=Laemchabang Port, TPT=Thai Prosperity Terminal, BMTP=BMT Pacific Port, UTCT=Unithai Container Terminal, KSSP=Kerry Siam Seaport, SHB=Sriracha Harbour.

Table 7. Weights of subcomponents in case of imports

Component (weight)	Subcomponent (weight)	Average scores for each port						
		BKP	LCP	TPT	BMTP	UTCT	KSSP	SHB
1. Infrastructure (23.8%)	Yard storage area (32.2%)	2.76	3.58	3.18	3.36	3.00	3.00	2
	Berth length (20.5%)	2.59	3.61	2.95	3.27	3.20	3.20	2
	Highway access (22.7%)	2.39	3.47	2.95	3.09	3.00	2.40	1
	Coastal and rail access (24.6%)	4	3	1	2	3	1	1
2. Port management (29.1%)	Port labor skill (22.7%)	2.76	3.58	3.23	3.55	3.00	3.40	2
	Safety (23.5%)	2.54	3.61	3.14	3.27	2.80	2.80	2
	Handling capacity (30.8%)	3.02	3.58	3.36	3.55	3.20	3.20	3
	Traffic management (23.1%)	2.24	3.24	3.00	3.82	3.00	2.40	3
3. Customs process (25.1%)	Customs officer's skill (24.1%)	3.20	3.45	3.32	3.55	3.40	3.20	3
	Paperwork system (29.1%)	3.51	3.66	3.45	3.64	3.20	3.40	4
	Customs efficiency (28.3%)	3.59	3.63	3.32	3.55	3.20	3.20	3
	Port coordination (18.5%)	3.22	3.45	3.36	3.55	3.40	3.20	3
4. Equity in customs law enforcement (22.0%)		3.05	3.37	3.23	3.45	3.60	3.20	4
No. of freight forwarder respondents		41	41	38	22	22	5	5
Port's Trade Facilitation Index		3.01	3.47	3.10	3.39	3.22	2.96	2.81

Note: Very satisfied (>4.50), Satisfied (3.51-4.50), Neutral (2.51-3.50), Unsatisfied (1.51-2.50), Very unsatisfied (≤ 1.50); BKP=Bangkok Port, LCP=Laemchabang Port, TPT=Thai Prosperity Terminal, BMTP=BMT Pacific Port, UTCT=Unithai Container Terminal, KSSP=Kerry Siam Seaport, SHB=Sriracha Harbour.

4.3 Port's Readiness for AEC

We ask freight forwarders to express their opinions whether Thailand's ports are ready for AEC. Most of them state that Thailand ports can accommodate higher trade volumes well; however, they would improve in some areas such as larger temporary storage area, equity in container checks, port sanitary and emergency response.

Regarding the improvement measures, freight forwards support the implementation of e-ports, waive some import customs, revision of Form D (certification of origin) acquisition, and ASEAN Single Windows. In addition, they expect ports to better train their staff, use higher handling equipment, exchange data with customs directly, and collaborate with government agencies and other ASEAN ports more.

4.4 Estimated Future Index Values Due To Development Plans

Since the indices in Tables 6 and 7 are the evaluation of port's trade facilitation in current period, they could be improved in 2013-2014 due to each port's development plan as well as customs improvement according to the AEC agreement in 2015. The changes due to port's development plans and short-term customs improvement plan for all ports that would likely be done in 2013-2014 are shown in Tables 8 and 9, respectively, while the changes due to AEC agreement that will happen in 2015 are shown in Table 10.

Table 8. Weights of subcomponents in case of imports

Port	Development Plan	Affected subcomponent
BKP	e-Gate Phase 2	Handling capacity
LCP	Phase 3 expansion	Yard storage area
		Berth length
	Single Rail Transfer Operator(SRTO)	Coastal and rail access
		Traffic management
	Coastal Berth	Coastal and rail access
e-Gate Phase 2	Handling capacity	
TPT	Berth expansion	Yard storage area
		Berth length
SHB	Berth expansion	Berth length

Table 9. Weights of subcomponents in case of imports

Customs	Affected subcomponent
Data connectivity (e-Customs, e-Licensing, e-Certificate)	Paperwork system (Import and Export)
ASEAN Single Window (pilot project)	Customs efficiency (Import only)

Table 10. Weights of subcomponents in case of imports

AEC Agreement	Affected subcomponent
Roadmap for an ASEAN Community 2009-2015	Paperwork system
	Customs efficiency
	Equity in customs law enforcement
ASTP 2011-2015 or Brunei Action Plan	Port labor skill
	Equity in customs law enforcement
Roadmap towards an Integrated and Competitive Maritime Transport in ASEAN	Port labor skill
	Equity in customs law enforcement

From Tables 8 to 10, if these plans are successfully implemented on schedule, port's future trade facilitation might be estimated and recalculated as shown in Table 11. It shows that in 2013-2014, only LCP and BMTP can be up one level to "Satisfied" (3.51-4.50), while the rest remain the same. However, SHB will not change much since it focuses on bulk goods not container goods and has no plan in the short run.

In 2015, if AEC agreements are fully implemented, all ports would be in "Satisfied" level (3.51-4.50). Note that LCP still ranks the first among all as in the current scenario and will be close to "Very satisfied" level (> 4.51).

Table 11. Weights of subcomponents in case of imports

Port	Import TF Index			Export TF Index		
	Current	2013-2014	AEC (2015)	Current	2013-2014	AEC (2015)
BKP	2.95	3.27	3.94	3.01	3.17	3.90
LCP	3.44	3.96	4.46	3.47	3.92	4.47
TPT	3.07	3.30	3.91	3.10	3.20	3.89
BMTP	3.41	3.55	4.03	3.39	3.46	4.00
UTCT	3.25	3.45	3.82	3.22	3.32	3.77
KSSP	2.97	3.19	3.79	2.96	3.04	3.74
SHB	3.01	3.13	3.65	2.81	2.90	3.52

5. CONCLUDING REMARKS

This research develops trade facilitation indices for both imports and exports at 7 international ports in Thailand by applying the Analytic Hierarchy Process (AHP). The indices consist of four elements, i.e., 1) port infrastructure, 2) port management, 3) customs procedures and 4) customs law enforcement efficiency. The data in this study are from 42 freight forwarders respondents. The indices show that most ports just passed current expectation of freight forwarders and will need some improvements to facilitate the future demand according to AEC in 2015.

In summary, the indices present here show port's trade facilitation that could be much improved if port operators or customs have done some development plans or follow the AEC agreements as shown in the future estimated index values. These indices can be used for relevant agencies to evaluate themselves or prioritize components to be improved. In addition, they can be benchmarks for comparison among themselves.

This research has some limitation. First, some small ports in this study have very few users (KSSP and SHB), then have few survey respondents. Therefore, results from these ports could be inconclusive. Next, future indices were estimated given the current freight forwarder expectation. Hence, these values are too rough if the plans are not fully implemented or freight forwarders might have higher expectation in the future. Lastly, each port was built for different functions and might serve different user type, the comparison among them by using an index with the same weight might not be technically appropriate.

For future research direction, more ports in Thailand and others would be studied to understand the level of trade facilitation for Thailand ports among trading partners. Also, in 2013 and 2015, the surveys would be done again to see if port and customs improvements can really increase port's trade facilitation index as estimated.

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