IMPACT OF PORT PRICING POLICIES FOR INCREASING THE EFFICIENCY OF PORT UTILIZATION

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Introduction

A port is an important part of supply chain that provides transshipment services especially for cargoes movements. There are many activities and stakeholders concerned to the port services such as freight forwarders, shipping lines, terminal operators, and customs. Laem Chabang port (LCP) is a major port in Thailand that is owned and regulated by the Port Authority of Thailand (PAT). In LCP, there are seven container terminals, a multipurpose terminal, a RO/RO terminal, a passenger RO/RO terminal, a cargo terminal and a shipyard terminal as illustrated as Figure 1. These terminals are operated by the private sectors under the contracts between them and the PAT (The Port Authority of Thailand, 2013). In the first stage of LCP development, the PAT aimed to encourage many private companies to invest and manage the terminals in LCP. Therefore, the PAT attempted to propose incentive port charging with the minimum costs which mainly focused on covering the initial investment.

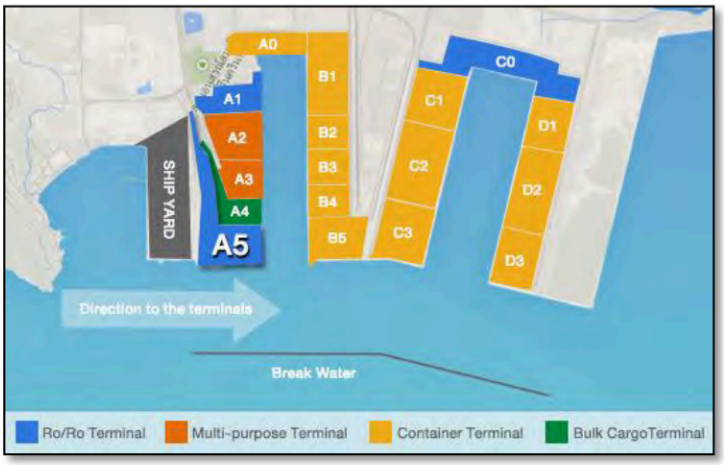

Figure 1: Layout of terminal operators in LCP
(Namyong Terminal Public Company Limited, 2013)

LCP is currently the main port for import and export cargoes that is continuously increasing to around 5 million TEUs. However, truck is the main transportation mode that transport the containers as demonstrated in Figure 2.

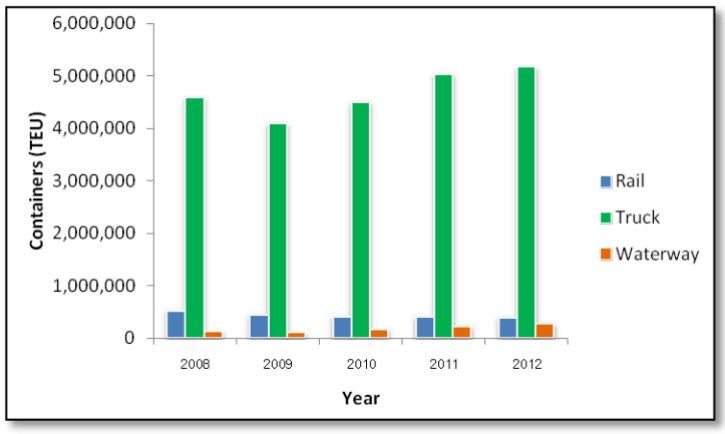

Figure 2: Statistics of Import-Export Cargo Containers through Laem Chabang Port, Fiscal Year (Modified from Laem Chabang Port, 2013)

Because of the unbalance of sharing in transportation mode choices as demonstrated in Figure 2, a huge volume of haulage trucks caused a serious traffic jam, i.e. a long queue length was occurred around 3 kilometers at the front of entrance gates as shown in Figure 3.

Figure 3: Traffic jam at the entrance gates

Moreover, in view point of fairness in market competition, the PAT has to prepare suitable port pricing strategies for new concessions contracts. Without social costs consideration and appropriate port charging policies, LCP will have traffic jam in the port again as it often occurs. Therefore, this research aims to analyze the proper alternatives of win-win port pricing policies. Win-Win policy can provide an important role to increases the efficiency of port infrastructure utilization. This research analyses various port pricing strategies for increasing the efficiency of port infrastructure utilization. This research also highlights how port pricing policies affect to the social impact especially traffic congestion.

Literature Review

There are many studies on port pricing as reviewed by Acciaro (2013). He reviewed over 60 papers and classified the researches in five areas consisting of strategic pricing, pricing and infrastructure cost recovery, pricing and market conditions, pricing and external costs and empirical research. The paper highlighted the current gap and demonstrated the interesting attentions. Therefore, there were very few researches that developed analytical models of strategic pricing, especially the interaction between various types of charging practices to reduce the negative external impacts.

To apply a theory about port pricing, Maffii, Parolin and Ponti (2010) demonstrated how to implement the economic theory to the practice. Generally, the theory sets the social marginal cost as the first-best condition. However, in case of failure to set the first-best condition, the second-best condition can be implemented. To implement the second-best condition, some serious problems should be awareness.

Moreover, Bandara, Nguyen and Chen (2013) reveled the seaport infrastructure pricing from data of 159 seaports and evidenced that cost-based approach was the major role in port pricing. However, Tovar and Wall (2014) indicated that the impact of variation of demand on port infrastructure costs should be considered in the port pricing policy.

Haralambides and Gujar (2011) explained the economic recession that affected to the international shipping and port sectors. India's dry port was considered to improve the supply chain efficiency. Thus, they argued the competition-enhancing by using public-private partnerships (PPPs) as same as demonstrated by Hamzah, et al (2014). They also highlighted the necessary legal, regulatory and policy too. Hence, Song and Geenhuizen (2014) analyzed the effect of port infrastructure investment and regional economic growth in China. The results from analysis discovered the positive impact to economic development. In

addition, they demonstrated the positive effect of the connectivity of transport network improvement especially intermodality among various traffic modes. Therefore, performance of port should be evaluated. Talley, Ng and Marsillac (2014) used the concept of port service chain and a service network to measure the quality of port services.

According to existing studies on port pricing, they highlighted the financial approach, impact of variation demand, social marginal cost, and lots of studies in cost-based approach. However, there is a few studies that analyzed the proper alternatives of win-win port pricing policies by using incentive KPIs to encourage the private sector to increases the efficiency of port services.

Methodology

This research proposes various port pricing strategies to find the proper approach. Thus, a research methodology is described as:

- The first step is to collect related data such as historical statistics of import-export containers, investment costs of LCP, operations costs and others. In this step, we can receive history demand and trend for the future. Additionally, we can estimate the initial investment in LCP form the PAT.
- The second step is to convert the investment cost from the PAT to be annually costs throughout the life cycle of the project or concession contract which is around 30 years.

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

where A is an equivalent annual cost (Baht)
P is an initial investment cost (Baht)
i is an interest rate (%)
N is a project period (years)

- The third step is to propose various alternatives as the followings:
    - Current condition: cost-based approach with minimum port charging to make an incentive for the private sector during the first stage of LCP development
    - Alternative 1: cost-based approach based on new fixed fee and regularly increasing in additional port charging along with higher containers (demand).
    - Alternative 2: cost-based approach based on new fixed fee and moderately increasing in additional port charging along with higher containers (demand).
    - Alternative 3: cost-based approach based on new fixed fee and suddenly increasing in additional port charging which focuses on the assumed port capacity (600,000 TEUs). This concept is to utilize the congestion pricing which aims to relieve the traffic congestion based on extraordinary marginal costs.
    - Alternative 4: cost-based approach based on new fixed fee and incentive variable fee by using some KPIs to make an incentive for the private company. That means, we encourage many terminals to improve their services which reduce the marginal social cost. Thus, the PAT can make incentive for them by decreasing the port charging.
- The forth step is to demonstrate analysis results. We aim to maximize social profit by providing more services until our marginal costs is equal to the price. However, in the viewpoint of private sectors, they attempt to get demand until their marginal costs is equal to their marginal revenue that is the profit maximizing point.

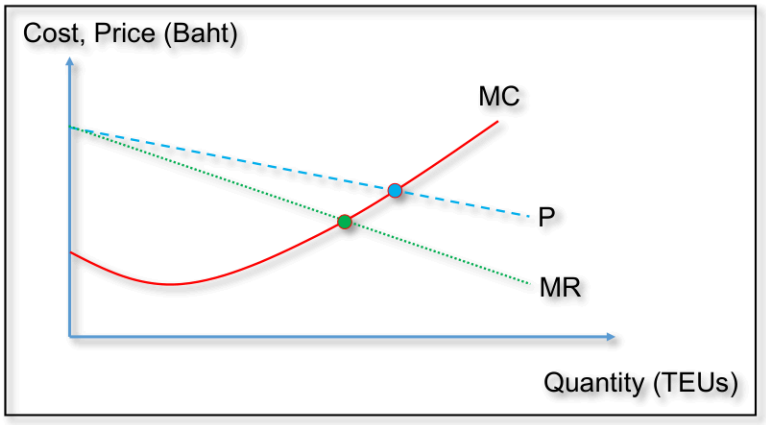

Figure 4: Profit Maximizing Point

- The last step is to summarize and discuss the proper alternative.

Results and discussions

To implement the new contracts, this research used the data based on the historical statistics of containers flows through focused terminal operators as shown in Table1.

Unit: TEUs/year

Fiscal Year	X1	X2	X3	X4	Average
2009	799,766	500,604	505,173	605,499	602,761
2010	817,121	469,263	604,765	644,473	633,906
2011	738,881	444,457	641,332	725,980	637,663
2012	752,058	542,508	599,251	815,489	677,327
2013	722,645	535,616	489,485	880,725	657,118
Average	766,094	498,490	568,001	734,433	641,755
Length of birth (m.)	300	300	300	300	300
Average containers/m.	2,554	1,662	1,893	2,448	2,139

Table 1: Quantity of containers through LCP

From table 1, we can notice that most of terminal operators services containers more than 600,000 TEUs which are the capacity of each terminal. Some terminal operators have customers less than the capacity such as 498,490 TEUs per year. This amount of containers reflects the relationships between operators and customer and their business strategies. However, the high volume of customers affects to theirs service time at the terminals as described in Table 2.

Container No.	Terminal	Main Gate		Sub Gate		Lead time (hrs)
xxxU14438xx	xx	23-04-2015	23:17	24-04-2015	1:36	2
xxxU68272xx	xx	23-04-2015	22:45	24-04-2015	0:46	2
xxxU85769xx	xx	23-04-2015	23:25	24-04-2015	2:45	3

xxxU09297xx	xx	23-04-2015	23:35	24-04-2015	5:21	6
xxxU71481xx	xx	23-04-2015	04:16	24-04-2015	06:32	2
xxxU91652xx	xx	23-04-2015	07:30	24-04-2015	10:06	2.5
xxxU78962xx	xx	23-04-2015	04:30	24-04-2015	06:38	2
xxxU71618xx	xx	23-04-2015	03:33	24-04-2015	05:55	2.5
xxxU30544xx	xx	23-04-2015	07:00	24-04-2015	09:30	2.5
xxxU30544xx	xx	23-04-2015	07:20	24-04-2015	09:50	2.5

Table 2: Example of service times at some terminals

From Table 2, we can see the high variation of lead times between main gate and terminals that ranges from 2 to 6 hours. Moreover, the PAT did not have any key performance index about service time at the terminals. When some terminals have demand more than their capacity, these amount of truck volume will generate the queue length in the roadway. Additionally, the current condition of the concession contract attempted to make incentive for the investors to get more demand during the development of the LCP. Therefore, the demand that higher than 600,000 TEUs will be benefit for the investors that makes them to get lower average cost as shown in Figure 5.

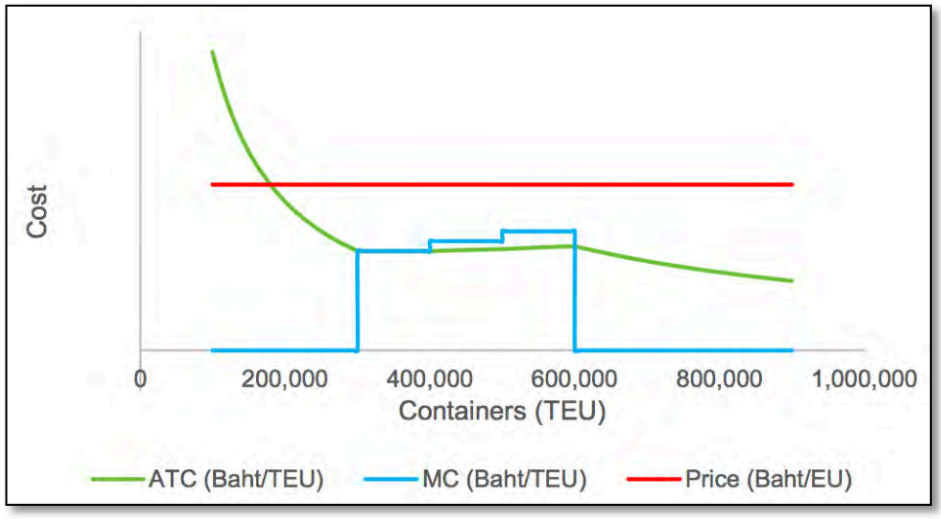

Figure 5: Current condition

From Figure 5, it cause the unbalance of market competition especially for the new comers. Moreover, the port utilization also will congested in some specific terminal that affects to other terminals. Hence, we propose the first alternative to increase the port charging every 100,000 TEUs as illustrated in Figure 6. However, it seems that these additional charges may not high enough to control the capacity of operations. Nevertheless, the operations of terminal also are not incentive to make them to improve their service time according to higher demand too.

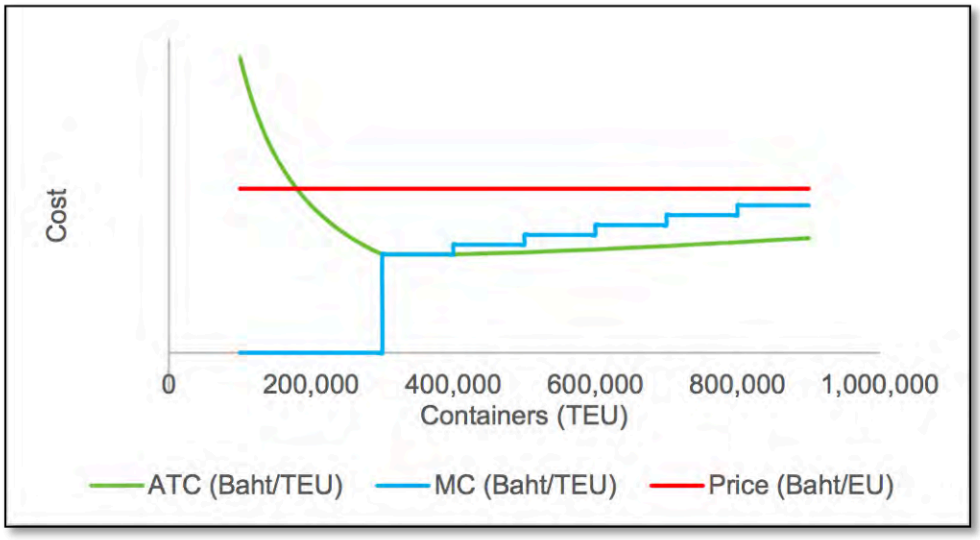

Figure 6: The first alternative

To distribute the demand at each terminals to be around 600,000 TEUs, we propose to increase more additional charges when the demand is over 600,000 TEUs as demonstrate in Figure 7. The investors will stop their services at around 700,000 which is the point of MC=MR to get the highest profit.

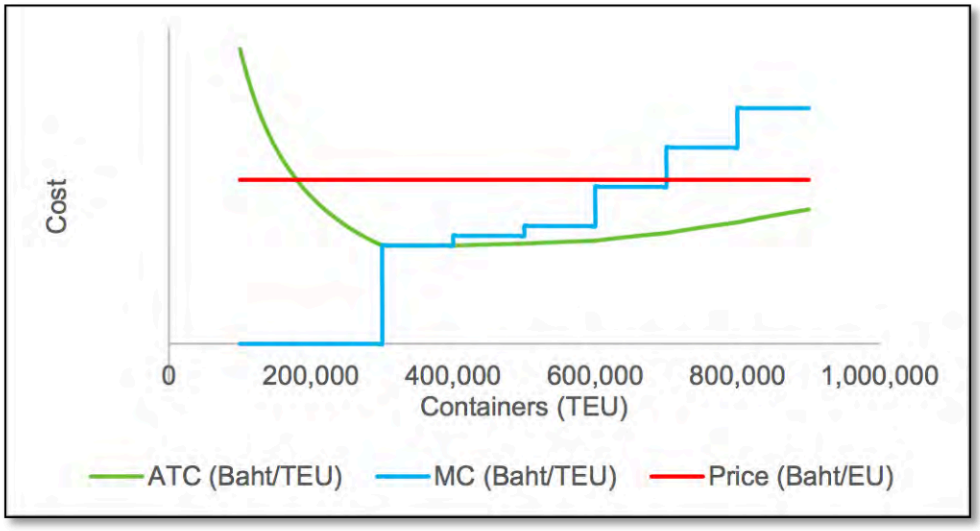

Figure 7: The second alternative

The third alternative is to strictly control the demand at 600,000 TEUs as Figure 8. We can notice that there are very high additional charges when the container demand overs 600,000 TEUs. However, this may discourage the investors to invest and may obstruct the growth of the LCP.

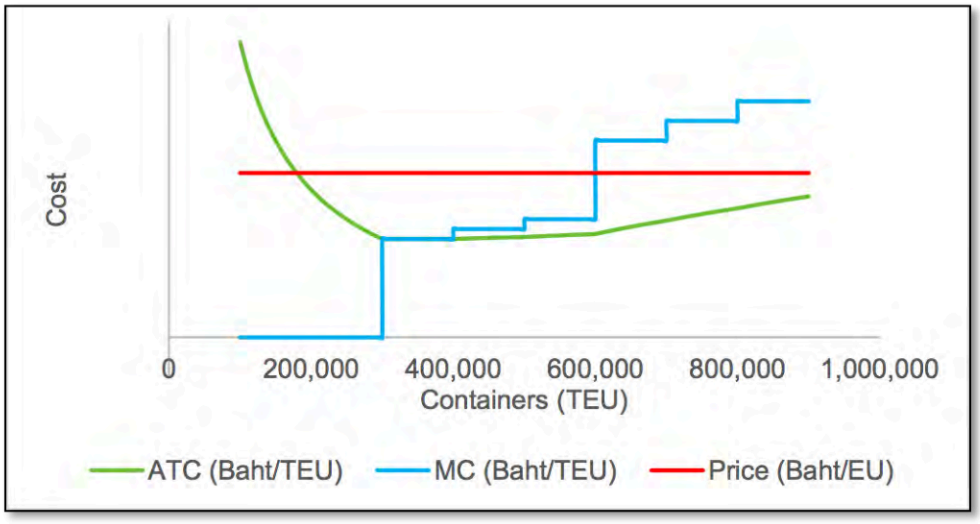

Figure 8: The third alternative

Nevertheless, these three alternatives seem to create high negative impact to all stakeholders. The first alternative can cause negative impact to the regulator. On the other hand, the second and the third alternative cause unattractive to the private sectors and inefficiency of market competition.

Therefore,the last alternative, we propose to charge them less costs if the terminal operators can improve their efficiency based on the implemented KPIs, i.e. improving their service time to less than xx minute per TEU, decreasing the quantity of truck share by increasing both rail and waterway shares. Thus, the PAT may regulate the port pricing as illustrated in Figure 9. This can make more incentive to the private sector which make more attractive too. We can notice that, private sectors can provide more additional service around 200,000 TEUs which is nearly the highest average demand as demonstrated in Table 1. Moreover, we can increase the port services and port infrastructure utilization whereas many stakeholders can get benefit.

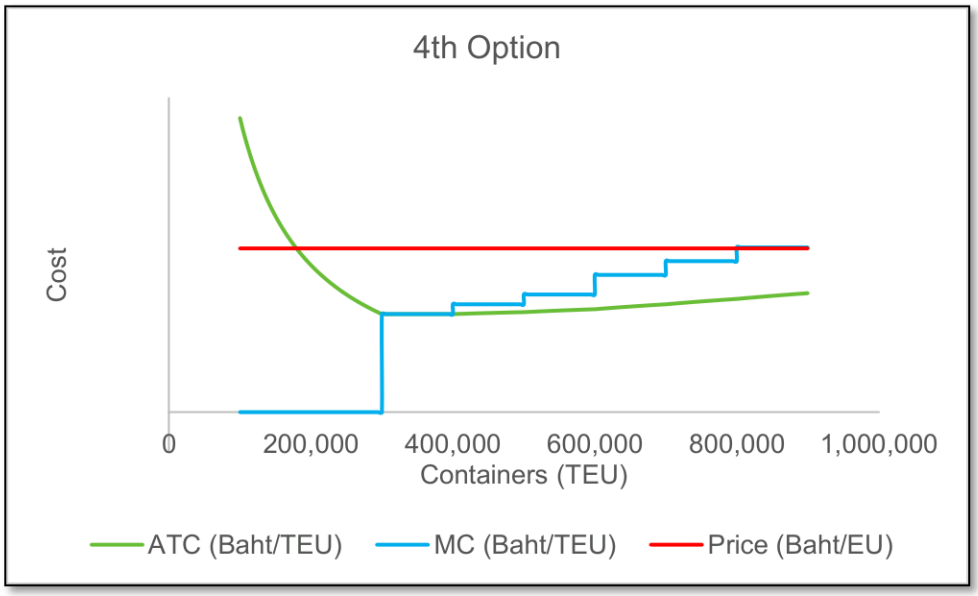

Figure 9: The forth alternative

Conclusion

This research proposes various pricing strategies to discover the traffic impact in port. Thus, the suitable alternatives should be implemented. The existing cost-based charging firstly attempts to make an incentive for many private companies to operate the terminals. From this policy, many terminals gain several benefits while the PAT lost some proper benefits. Then, after ending the old concession contract, the PAT should have appropriate alternatives by considering various factors.

From the cost-based approach, the result of the first alternative demonstrated that the private sector received lots of profits. However, other stakeholders still get the same impacts such as traffic jam, imbalance of modal choices because of no KPIs for the terminals. Then, the second and the third alternatives can potentially make negative impacts to the existing market especially the private sectors because of too high additional port charging. Moreover, this policy is also not incentive for the private sectors. However, this concept aims to control the excess capacity (demand that is over 600,000 TEUs per year) to relieve the traffic congestion. Thus, both policies can reduce the attractiveness for improving their operations too. Finally, results from the forth approach that attempts to utilize the incentive pricing policy by considering efficiency of port utilization. The proposed method can charge the terminals less than both the second and the third alternatives in case that the private sector can reduce the social impacts. Therefore, the appropriate benefit for whole stakeholders can make incentive for port development and win-win solution for them.

However, this research still does not consider the in-depth impact of the traffic jam situation from the proposed pricing policies. Thus, we will utilize the simulation to make empirical study for the future research.

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