Improving Railway Transportation Logistics System:  
A Key Step of Thailand to be ASEAN Supply Chain Connectivity Hub

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Abstract—Over almost a decade, the AEC countries (ASEAN Economics Community) has been experiencing a long period of economic growth, leading to transition from a predominantly agricultural economy to an industrialized economy. Other than the skills of the people and the availability of resources, this feat has been primarily the result of massive local and foreign investment. Most of investment has occurred in the many ASEAN countries, who are manufacturers, such as Thailand, Laos, Cambodia and Myanmar. As may be expected, the industries expand, and with this growth the demand for infrastructure system especially in transportation system supporting logistics activities increases. Long distance freight transportation distribution plays crucial role in driving AEC social and economics expansion by means of transporting and distributing goods to different regions in a country. However, the demand of road freight transportation has been continuously growing, while that of railway mode tends to decline. However, such congestion is associated with higher transportation cost, more fuel consumption and environmental impacts, which are direct/indirect costs to logistics transportation service provider resulting in an increase in total cost of production.

To the public and private players in the transport logistics industry, rail/road intermodal transport policy is a key national agenda. To realise this policy, freight transportation activities should link to several transport modes in single/multiple coordinate freight movement. However, inadequacy of railway infrastructure and facilities causes disruptive intermodal activities. In the areas where the traffic volume is high, track doubling needs to be constructed. Apart from increasing track capacity, the expansion of supporting facility and in-land/ at-port infrastructure are also essential.

This present work aims to discuss current status and problems associated with the long distance freight transportation in Thailand, and to suggest solution to achieve the improvement, which is the key link to the implementation of intermodal transportation policy. The focus of this paper is, however, given onto opportunities of railway infrastructure redress as a main tool to realise this national policy.

Keywords—Railway Freight Transportation, ASEAN, Supply Chain, Logistics.

I. INTRODUCTION

Over the past decade, Economist Intelligence Unit (EIU) indicates that, ASEAN has rapidly grown in importance to the global economy. It share of global GDP, measured in purchasing-power parity terms, increased from 26.8% in 2001 to 33.8% in 2010. By 2016, the Economist Intelligence Unit (EIU) expects this proportion to rise to 38.9% [1]. There are several authorization trend associated with Asia's rapid growth and development that have been driving its transport and logistics (T&L) sector. First, intra-ASEAN trade has boomed as manufacturing supply chains have spread and deepened across the region. According to the World Trade Organisation (WTO), the share of intra-ASEAN exports as a proportion of total ASEAN export has risen from 42.1% in 1990 to 52.6% in 2010 [2]. These indicate supply chain have become fundamental to global manufacturing output.

Increasingly, integrated networks have boosted demand for, among other things, influence to the growth in various business sectors, including Freight transportation. Freight transportation, in particular, is one of today's most important activities, not only as measured by its own share of an each ASEAN nation's gross domestic product (GDP), but also by the increasing influence that the transport and distribution of goods have on the performance of virtually all other ASEAN economic sectors[3].

Today, the goods distribution industry supplies a range of logistic services within a supply chain. It originally evolves from the provision of basic transportation of goods. Presently, the distribution business encompasses a number of supporting services which can include the provision of transport itself, as well as quality management, global market place, just-in-time inventory control and order processing, warehousing and storage. Increasingly sophisticated support services, such as order picking, packaging labeling, excise duties control and management, are also accounted for [4],[5],[6].

Recently, ASEAN logistics and intermodal management have gained wide interest from freight transport players. In order to exploit advantages of each mode of transportation in terms of cost, service, reliability and safety, the ability to chain at least two different transport modes in a single freight movement should be considered [7],[8],[9],[10]. As stated by Arnold et al. [11],

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"Intermodal transportation is defined by the European Conference of Ministers of Transport (ECMT) as the carriage of goods by at least two different modes of transport in the same loading unit (an Intermodal Transport Unit – ITU) without stuffing or stripping operation when changing mode. The major part of the journey is done by rail, inland water or sea, and any initial and/or final legs carried out by road are as short as possible". It also involves the use of an extensive network of truck to/from rail, truck to/from barge and rail to/from barge transfer facilities [12]. In this contribution, intermodal transportation is characterised by the combination of the advantages of rail and road, i.e. rail for long distances and large quantities, and road for collecting and distributing over short or medium distance [13].

In case of Thailand, a long period of economic growth has led the country through a transition from a predominantly agricultural economy to an industrialized economy. Today, Thailand represents one of the ASEAN countries with continuous growths both in demands of goods and services. Other than the skills of the Thai people and the availability of own resources, this feat has been primarily the result of massive local and foreign investment [14].

As may be expected, the industries expand, and with this growth the demand for infrastructure system especially in transportation system supporting supply chain and logistics system and network activities apparently increases. However, unlike in developed countries, roadway system in Thailand has been largely invested countrywide, while the investment in the railway and its facilities system considerably declines. Consequently, the Thai railway system tends to lose its competitiveness to the road transportation, despite of its several advantages such as the high efficiency, large freight volume, cost effectiveness, time punctuality, speed safety and low energy consumption, specifically at medium to long distance transportation [15],[16],[17]. Moreover, while the railway system investment requires construction of own infrastructure and needs to bear with large debt payment, road construction investment experiences relatively low risks of return. This is because the road users are subsidized in that charges they pay do not cover the full cost or even the marginal cost of using the roads, whereas the railway customers need to pay in full. This makes the investment of railway system in Thailand becomes even more challenging.

The objective of this present work is to suggest options to the improvement of long distance freight transportation, which is the key link to the implementation of the intermodal transportation policy. The focus of this paper is, however, given onto opportunities of railway infrastructure redress as a main tool to realise this national policy.

II. OVERVIEW AND OPPORTUNITIES OF THAILAND AND RAILWAY FREIGHT TRANSPORTATION

The efficiency of Thailand's transport system is an issue of some significance. As transport is an essential supporting sector for the whole economy, gains in transport efficiency will lower production and distribution costs and also help improve the country's external trade position.

In spite of all the advantages of rail transport on fuel efficiency, environmental friendliness, traffic congestion and safety, the railway remains a relatively minor player in the Thai transport picture compared to road transport. The railway accounts for about 15 percent of all inter-provincial passenger movement and only 2 percent of all inter-provincial freight movement. To a large extent, this is due to the relatively poor competitive position in Thailand of rail versus road (and also air and waterway) transport. The principal disadvantage of rail transport for freight services is its inefficiency in door-to-door operations where the State Railway Authority of Thailand does not connect directly with the origin or destination organizations. In such cases, the overall transport costs may involve trucking at either end of the route, with high handling costs for transferring from truck to train and train to truck. For short distances, this additional cost is greater than any savings gained by rail transport.

Thailand has long been working on transportation network which links north-south corridor from southern China to Singapore. The most top fourth investment countries along east-west corridor, Cambodia-Laos-Myanmar-Vietnam, called CLMV, are in agreement to build a road and rail linking each other including development network to India, which called reverse L trade land as shown in Fig 1, Fig 2 and Fig 3. Together with the intention to establish a new distribution channel to the Middle East, Africa and Europe through Pak Bara Port on the Andaman Sea to serve Thai foreign trade goods and transit goods having the origin and destination in Southern China, the railway linkage from that Thai-Laos border to the new port will form a crucial linkage complementary to other transport corridors and thereby creating an integrated multi-modal transport network in the entire of among AEC and the Asia region.

Fig 1 Logistics Supply Chain Hub
Source: Board of Investment Thailand

Asian Development Bank (ADB) [19] and Department of Export Promotion states ADB [19] and Department of Export Promotion states
To capture the potential opportunities and expand its total usage share, it is most important to improve the current railway freight transportation system and their facilities. Also, by fully exploiting the advantages of railway transport, which will result in cost minimization especially over medium to long distance transportation, this will form a great contribution to the implementation of the national intermodal operation policy.

III. ISSUES ON NETWORK INTERGRATION
RAIL FREIGHT TRANSPORTATION TOWARDS THE DEVELOPMENT OF INTERMODALISM

Railway freight transportation constitutes a vital link in mass movement of freight on land. However, the movement of freight in bulk and the inherent inflexibility to travel to many places have resulted railway in the loss of market share to the road sector. The low movement of freight trains is hampered by the lack of dedicated tracks around the country and by the lower preference compared to road movement as given by costumers [20]. Several issues that are considered to cause the low movement of freight trains and lessen the potential of the intermodal transportation development involve problems with equipment, terminal/distribution center, railway track and railway vehicle [20,21] and can be classified into 3 main categories as follows.

A. Inadequate Utilisation of Railway Freight Transportation Potential

Railway freight transportation typically concentrates in certain areas. As for container transportation, for example, almost all service is dominated by the transportation between Bangkok and Eastern Seaboard area (ESB). Petroleum products are mainly transported between Bangkok and Northern region, while cements are mainly transported between Bangkok and Northern region. The limitation of service area with specified commodities narrows down the freight transportation market. Railway transportation yet mostly intends to capture large-scale clients, for example, for container service. This in turn results in loosing future potential business opportunity to expand freight service for train, and the freight facility is not fully utilised because there is not enough potential clients.

B. Quality of Railway Freight Vehicles and Infrastructure

State Railway of Thailand (SRT) [22] operates freight service with old locomotive and wagon. This results in shortage of rolling stock for railway freight service. The service age of locomotive and wagon of railway vehicles are shown in Table 1 and 2 respectively.

Moreover, many parts of railway track life are expired. Rail, wood-sleeper and level crossing are damaged (as shown in Fig 3, 4 and 5), which seriously disturbed the railway operation.

<table>
<thead>
<tr>
<th>Year</th>
<th>Diesel Electric Locomotive</th>
<th>Diesel Hydraulic Locomotive</th>
<th>Diesel Hydraulic Railcar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-15 Years</td>
<td>31%</td>
<td>18%</td>
<td>52%</td>
</tr>
<tr>
<td>16-30 Years</td>
<td>36%</td>
<td>47%</td>
<td>31%</td>
</tr>
<tr>
<td>&gt;30 years</td>
<td>33%</td>
<td>35%</td>
<td>7%</td>
</tr>
</tbody>
</table>

Source: SRT (2010)

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of Vehicle</th>
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<tbody>
<tr>
<td>1-15 Years</td>
<td>31%</td>
</tr>
<tr>
<td>16-30 Years</td>
<td>36%</td>
</tr>
<tr>
<td>&gt;30 years</td>
<td>33%</td>
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</tbody>
</table>

Source: SRT (2010)

Fig. 3. Damaged rail.
C. Inadequate Capacity of Railway Infrastructure and Supporting Facilities

Additional to the narrow market, limited potential clients, and expiring track and vehicles, low capacity and low efficiency of freight services themselves obstruct the expansion of the railway use. SRT (2010) operates train services over a network of 47 provinces with approximately 4,129 km. However, only 165 and 83 km are double and triple tracks, respectively. Moreover, there are approximately 620 rail stations and stopping locations in Thailand, but only a minimal share is available for bulky freight transportation. In total, 292 of out 620 rail stations deal with freight services. However, only 55 stations involve large-volume transport with more than 10,000 tons of freight. Only those 10 largest rail freight stations that deal with more than 75% of the total freight volume in the country. This means that only these large stations are equipped with loading facility and are available for bulky cargo transportation. In total, 292 of out 620 rail stations deal with freight services. However, only 55 stations involve large-volume transport with more than 10,000 tons of freight. Only those 10 largest rail freight stations that deal with more than 75% of the total freight volume in the country. This means that only these large stations are equipped with loading facility and are available for bulky cargo transportation.

For example, the demand container transportation has been continuously increased during past few years. However, the growing demand has been constrained by limited track capacity and rolling stock. Lad krabang Container Depot (LICD)'s capacity is almost fully utilized with current volume of containers. Rail stations in the other regions facing problems with limited spaces and lack of supporting facilities, especially in rural area.

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

To the public and private players in the transport industry, rail/road intermodal transport policy is a key national agenda freight transportation activities should link to several transport modes in single/multiple coordinate freight movement. However, inadequacy of railway infrastructure and facilities causes disruptive intermodal activities, taking into account the integration of intermodal transportation development policy as the main vehicle to achieve the target.

The recommendation is firstly given to identifying potential business opportunity for SRT to quickly improve its profitability. In the areas where the traffic volume is high, track doubling needs to be constructed. Also, the possibility to expand the freight business by integrating rail with other transportation modes should be considered.

In a defined context, road transport has many more advantages to rail in term of time-saving potential, punctuality, frequency and convenience offered by “door to door” service. On one hand, it is highly possible that road transport will continue to dominate the freight market in future, and overall freight transport system should be delineated based on the road transport. In other word, the road transport would play a core role, whereas other supportive activities are performed by others such as rail, waterway and air transports. On the other hand, it cannot be expected to drastically increase rail freight volume and function to meet the growing demand in future. Also, it is the fact that rail transport has more advantages in transporting longer distance, with more bulky and heavy commodities and cheaper cost. If the commodities are not strongly required to be transported quickly, such advantages in rail transportation would be much more attractive. As a result, there is potential opportunity to expand the freight business by integrating rail with other transportation mode, particular the road. For example, for long distance transportation (inter-region) is done by railway and collection and distribution transportation (door-to-door) is done by truck.

In order to provide sufficient and efficient service, rail freight station should be restructured or reallocated to the areas with more freight volume and are in the strategic locations. The possibility to extend potential stations into regional distribution center and transport hub should also be considered [23]. Overall, this will contribute to reduce operation cost, resulting in improving efficiency of rail transport service as a whole. To achieve this, it is important to formulate a better integration of freight transportation service between railway and other transportation modes such as integration between rail and truck and integration between waterway and rail should be developed. This swift mode transfers are the key to successful intermodal operation [24].

Secondly, the focus should be given onto the improvement of the railway infrastructure that directly serves the intermodal strategies. Overall, railway freight transportation network should be delineated. Based on it, necessary infrastructure development to form the network, in particular, Inland Container Depot (ICD) and/or Distribution Center (DC) and expansion of freight stations, should be taken into account at least at the center of each region.

Thirdly, service coverage for container transportation should be extended. During the past few years, demand for container transportation has increased continuously due to its safety and convenience of use, in particular, for materials, parts and machines. Since this tendency is
highly expected to continue in near future, service areas for container transportation should be expanded, and integration of container transportation with road and marine transportsations should also be strengthened.

V. CONCLUDING REMARKS

Due to the prioritized government policy, investment has been given to road construction rather than to railway network. Thus, railway infrastructure is inevitably deteriorated by limited investment and maintenance. Railway transportation mode cannot increase freight services both because of the limitation of special wagons for bulky merchandises and the limitation of number of station stations and service coverage. The expansion of rail freight services thus are constrained and discouraged. Inadequate integration with off-road transport service also disturbed to development of new freight services.

As a result, insufficient railway infrastructure, facilities and vehicles makes freight operation become less competitive to its rival, the truck, in terms of speed and frequency. However, the excessively growing demand of for railway utilization and the government intention to implement intermodal transportation policy have make possible to expand the railway services with success. To realise this policy, recommendations are proposed to the RST. In the areas where the traffic volume is high, track doubling needs to be constructed. Also, the possibility to expand the freight business by integrating rail with other transportation modes should be considered. Apart from increasing track capacity and chain integration, the expansion of supporting facility and in-land/at-port infrastructure are also essential.

In this rapidly developing business environment, there will be the need for the major freight movements right into a center of region, where product is dispersed quickly. In this case railway transportation will become the most cost effective mode for moving large volumes of product over long distances. These products then are realign into smaller unit and delivered by designated quantities to the customer requirements by road. It is vital that the right balance of speed, service and costs is achieved in order that the supply chain provides a competitive advantage in both service and cost. These factors, together with legisilation and technological developments, will ensure that intermodal logistics solution will increase in popularity.

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