The Development of Multimodal Transport and Logistics in Thailand: Plan and Actions

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Abstract: This paper has reviewed the development on multimodal transport and logistics services in Thailand with a view to understand as the key factors for supporting production and distribution system, inventory and distribution management, efficient logistics services, and enhance the competitiveness of Thai products thereby enabling Thailand to be a major player in the world trade by positioning it as the transport gateway and economic centre in the region. This paper has discussed key areas of multimodal transport and logistics services such as demand of freight transport, logistics costs, modal shift, effect of transport costs on trade, and the government policy and action plans towards the development of multimodal transport and logistics services, and the areas of improvement. Finally, the study has outlined as task ahead the national policy framework and action plans for a competitive, efficient and economic functioning of multimodal transport and logistics services.

Key Words: Thailand, multimodal, transport, logistics

1. INTRODUCTION

Thailand in 2007 had a GDP of US$256 billion, with a GNI per capita of US$3,917. Based on the World Trade Organization (WTO) data, Thailand in 2007 ranked 25th in world export with an export value US$153 billion, sharing 1.1% of the world total with 17% annual growth. Similarly, it ranked 26th in world import with a value of US$151 billion, sharing 0.99% of the world total with 9% annual growth. Thailand also ranked 27th in the export of commercial services with a value of US$29 billion, sharing 0.9% of the world total with 17% annual growth, and ranked 23rd in commercial import sharing 1.2% with 16% annual growth. The double digit economic growth during 1980s and 1990s has brought Thailand to a visible player in the international market, with a total trade of over US$304 billion. Similarly, based on the United Nations Conference on Trade and Development (UNCTAD), in 2008, Thailand had a trade relation with over 135 countries incorporating 244 commodities, with diversification and concentration indexes of 0.39 and 0.095, respectively. In the past till the last decade, Thailand had a highly favourable production and trade environment as it was a large exporter of agricultural primary and manufacturing products without any close competitor in the region. However, at present its terms of trade index is 96 at 2000 price. It also enjoyed a comfortable foreign direct investment, particularly Japanese investment in a variety of manufacturing industries including the vibrant automobile and electrical/electronic industries. Now several strong competitors like China and Vietnam have come up with
attracting new foreign direct investment and competing with cheaper products, both agricultural and manufacturing. Meanwhile, most countries have become members of WTO and within 2012 Thailand’s commitment to a full market access with minimal tariffs will enter itself into a fully competitive market, locally and globally.

Thus globalization has become the unidirectional move of the world economy. Thailand has started to move ahead with market economy since long, and now its success hinges on how fast and how smoothly it manages globalization and the market economy shaped by the phenomena of globalization. In this regard the Royal Thai Government has realized that Thailand should achieve high competitiveness and maintain it, not only to be in the forefront in the world market, but also to sustain its economy and establish itself as a major player in the world trade of merchandise and commercial services. In maintaining its competitiveness, Thailand should be able to produce better quality of products and bring them to the doors of consumers in competitive price. In this process, transport and logistics services should play a crucial role by bringing down the total transport and logistics costs and managing the just-in-time delivery of all inventories for the total distribution for production and consumption.

The starting point for the overall competitiveness, efficiency and economy in transport and logistics services is the development of a multimodal transport infrastructure and operation intertwined with logistics services. This notion has been recognized by the Royal Thai Government, and the Ministry of Transport (MOT) has started the development of multimodal transport system since 1993, with the objectives of developing a multimodal transport system and enable it to be the primary factor for the logistics services, to support transport system and entrepreneurs, to enhance the competitiveness of Thai products, and to position Thailand as the economic and transport centre in the region.

2. OBJECTIVE AND STUDY METHOD

This paper in the above context has aimed to analyze and discuss the Thai plans and actions towards a functioning multimodal transport infrastructure development and operation along with plans and actions for the full functioning logistics services in all channels. Deriving data and information from various published sources, including the report of the study on “The Development of Multimodal Transport and Logistics Supply Chain Management for Implementation of Action Plan” in 2006, the paper has reviewed the present status of the connectivity of transport and terminal infrastructure network, creation of economic corridors and network, regulations in the transport sector in this direction, development and enactment of clear legal regimes, including a multimodal transport Act and related regulations and rules, development of efficient communication-documentation channel, a well promoted multimodal transport operation system and capable human resources. Finally, the study has outlined as task ahead the national policy framework and action plans for a competitive, efficient and economic functioning of multimodal transport and logistics services.

3. AN OVERVIEW OF TRANSPORT AND TERMINAL DEVELOPMENT

Located in the centre of mainland Southeast Asia, Thailand has an area size of 513,115 sq km, and extends about 1,620 km from north to south, and 775 km from east to west. Thailand borders the Lao PDR and Myanmar to the North, Cambodia and the Gulf of Thailand to the East, Myanmar and Indian Ocean to the West and Malaysia to the South. It has a land
boundary of 4,863 km, comprising 1,800 km with Myanmar, 1,754 km with Lao PDR, 803 km with Cambodia and 506 km with Malaysia. It has a coastline of approximately 2,700 km. The country is divided into 75 Changwat (provinces), two Special Local Administrations, 796 Amphoe (districts), 81 King Amphoe (Super districts), 7,255 Tambon (local administrations) and 74,435 Muban (settlements/wards). Administratively, they are divided into two Special Local Administrations, 75 Provincial Administration Organizations, 1,158 Municipalities, 22 Nakhon Municipalities, 117 Muang Municipalities, 1,019 Tambon Municipalities, and 6,620 Tambon Administration Organizations. At the end of 2007, the total population of the Kingdom was estimated about 65.74 million. Thailand has its diplomatic relation with 178 countries and diplomatic mission in 64 countries. Similarly, there are about 50 export promotion offices overseas.

3.1 National Transport and Terminal Network

Thailand has a total road network of about 180,000 km, railway line of 4,044 km, inland water transport of 1,750 km, 37 airports, 25 ports, pipeline of 2,750 km, as well as three truck terminals, 16 container freight stations (CFSs), six inland container depots (ICDs), 25 container yards (CYs), 323 warehouses, 13 silos and 102 cold storages. These infrastructure installations constitute the total transport and terminal network of Thailand.

The total road network of about 180,000 km in Thailand constitutes approximately 64,600 km of highway (per two-traffic lanes) including 450 km of motorway and 22 km of concession road, 44,000 km of rural road, and 84,000 km of local road. Road is such a transport mode which virtually links all modes and connects all transport terminals. There are 42 international checkpoints or border-crossing points by road, including 29 permanent ones. These border-crossing points facilitate road transport to the neighbouring countries: Cambodia, Lao PDR, Malaysia and Myanmar.

The railway line is composed of single line (3,764 km), double lines (173 km) and triple lines (107 km). This network covers 47 provinces and all regions of the country, running from Chiangmai in the north, Nongkhai and Ubon Ratchathani in the northeast through Bangkok to Padang Besar and Sungai Kolok in the south. It also connects Aranyapathet in the east through Bangkok to Nam Tok in the west. Railway connections can link to three neighbouring countries from four border-crossing points, i.e. Laos through Nong Khai station, Cambodia through Aranyaparthet station, and Malaysia through Padang Besar and Sungai Kolok stations. Other main points of linkages are all seaports, including Bangkok port, Laem Chabang port and ICD Latkabang. Most railway lines in Thailand are very old and they cannot be used with full capacity though railway is well maintained by changing rail ties and gravel.

Thailand has a total length of 2,614 km coastline along the Gulf of Thailand and Andaman Sea. In addition, the inland water transport consists of 1,750 km in total. There are in total 25 ports in Thailand. The main ports for international transport are Bangkok port, Laem Chabang port, Songkla port, Phuket port and Map Tha Put port. However, only the Laem Chabang port has the port depth capacity for post-Panmax liners. The inland water transport is limited to the central Thailand only, i.e. from Bangkok to Nakhon Sawan and the major route is the River Chao Phraya, which can harbour international coastal ships to an inward route of 45 km from the estuary. Transport via other rivers, namely Pasak, Bang Pa Kong, Meklong and Tah Chean are trivial.
Regarding air transport, there are 37 civil airports in Thailand, seven of which (Don Muang, Suvarnabhumi, Chiang Mai, Chieng Rai, Phuket, Hat Yai, Ubon Ratchathani and Utapao) are international airports and the remaining 30 are domestic airports. Though the exclusive domestic airports connect only among themselves, the international airports establish connection with over 80 cities in more than 40 countries as well as they are among the busiest airports in terms of domestic transport as well including the Suvarnabhumi as the 19th busiest airport in the world.

Currently, there are two pipeline transport namely Thai Petroleum Pipeline Co., Ltd (THAPPLINE) and Fuel Pipeline Transportation Limited (FPT), extending for 2,750 km. The pipeline of THAPPLINE has two routes, the first one starts from the oil refinery group at Amphoe Si Racha at Chonburi province and ends at Sao Hai in Saraburi province, and the second route starts from the oil refinery at Map Tha Put industrial estate and ends at Amphoe Si Racha with a total length of 360 km. The FPT’s pipeline starts from the Bangjak oil refinery and ends at tank farm in Amphoe Bang Pa-In with a total length of 68 km. In addition, gas pipeline consists of offshore transmission with 1,359 km and onshore transmission with 1,031 km.

The transport terminals, which relate to the logistics services, are important facility for transport system, because freight transport requires collection, storage and distribution of all goods/merchandise including customs clearance. The transport terminals enable transport operation faster, cheaper, easier and efficient. There are three truck terminals, 16 container freight stations, six inland container depots, 25 container yards, 323 warehouses, 13 silos and 102 cold storages. So far the development of these terminals is concerned, the truck terminals and the container freight stations are solely invested by the Government; silos, cold storages and bonded warehouses are invested exclusively by the private sector; and inland container depot, container yards and public warehouses by both the Government and the private sector. However, except four container yards and seven public warehouses all are operated by the private sector.

The truck terminals are located in the outskirts of Bangkok. Off-dock container freight stations are located obviously along the River Chao Phraya, extending from Chonburi through Bangkok to Ayutthaya provinces. Similarly, the inland container depots, which are in limited numbers, are located around Bangkok as well. The container yards though spread along the coastal region are basically concentrated around Bangkok particularly all the private ones, and only the Government invested four container yards are located in four railway junctions in four provinces in the Northern, North-eastern and Southern regions. The warehouses, which were supposed to be spread all over the country, are located only in 19 provinces and they are found largely concentrated in and around Bangkok, as 24 of the total 85 warehouses are located in Bangkok followed by Samut Prakarn (16) and Chonburi (7). Public silos are also basically located in and around Bangkok. However, cold storages which are developed to manage seafood, fruits and vegetables and other specific products, are spread over respective production locations, particularly the seafood cold storages are spread over all coastal provinces and the vicinity of Bangkok. Yet, more than 50% of the total 102 cold storages in the country are located in Samut Sakorn, Bangkok and Samut Prakarn. Finally, the bounded warehouses, which are the numerous terminals and can be categorized as (i) manufacturing; (ii) general; (iii) duty-free shop; (iv) general bonded warehouse for exhibition; (v) general bonded warehouse for gasoline storage; (vi) dockyard; and (vii) general warehouse boundary for free trading activities, are also mostly located in and around Bangkok.
3.2 Transport Operation and Performance

Almost all major means of transport are utilized over various modes for transporting goods and commodities. In 2005, the major road vehicles were trucks which counter over 675,000, mainly of 6-wheel trucks and of over 10-wheel trucks in a relatively smaller lesser number. In 2004, the road transport handled over 435 million tons, which constituted 87% of the total domestic freights (see table 1). The transported goods and commodities include everything what needed to be transported including transport goods to and from the terminals or directly from other modes to the final users, both for production and consumption.

Regarding the railway transport, there are 150 trains; consisting of electrical diesel and hydraulic diesel. However, for commodity transport, only electrical diesel trains are used with the maximum speed of 80 km/hour. There are four types of cargo trains, namely (i) big bogey for general cargos; (ii) container bogey; (iii) cement bogey; and (iv) fuel bogey. A total 576 bogeys were utilized in 2004 to serve the railway transport demand and each bogey could carry between 38 and 42 tons. At the same year, 12.9 million tons of freights were transported by rail transport (see table 1), constituting 7.5 million tons of containerized freights, 3.1 million tons of fuel and petroleum products, and 2.1 million tons of combined cement, stone and sand. As the freight dominated by containerized cargo, the routes also were largely dominated by the two-way flow between Laem Chabang port and Latkrabang inland container depot.

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<td>Road</td>
<td>398</td>
<td>87.3</td>
<td>400.2</td>
<td>89.6</td>
<td>434.9</td>
<td>88.1</td>
<td>440.0</td>
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<td>86.8</td>
<td>430.3*</td>
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<td>2.0</td>
<td>9.8</td>
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<td>Inland Waterway</td>
<td>25.2</td>
<td>5.5</td>
<td>17.8</td>
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<td>5.1</td>
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<td>25.8</td>
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<td>29.6*/</td>
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<td>Coastal</td>
<td>23.3</td>
<td>5.1</td>
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<td>Air</td>
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<td>0.1</td>
<td>0.7</td>
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<td>Total</td>
<td>455.8</td>
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Remark: * Preliminary figures
1/ : Jan-Aug 2005
2/ : Jan-Sep 2005

Most freight transport ships in the inland water transport are non-motorized ships, and registered as canal boats. In total they are about 12,000 registrations. Most inland waterway transport is routing through the River Chao Phraya (about 53.9% of total domestic water transport), followed by Pasak River (30.1%), Bang Pa Kong (8.1%), Tah Chean (7.8%), and Meklong (0.1%), respectively. The freight transport volume in the River Chao Phraya and River Pasak is significantly higher to downstream than upstream, and most cargos transported towards downstream are soil, stone, sand, bagged cement, cassava plant, sugar, and rice. Most upstream cargos are coal, fertilizer, woods and wood products, animal feed, soybean, and fuel, among others. In addition, the international freight transport along the Mekong River is mostly related to commerce with Southern China, which is using the Chiang San port in Thailand. The important export goods are dry longan, and animal products. On the other hand, important imports are fruits, vegetables, and textiles.

The inland coastal freight transport routes mostly have origins or destinations at the coasts in the central part of Thailand, Eastern and Southern regions on the Gulf of Thailand coast. In 2004, the coastal freight transport volume was 25.9 million tons, i.e. 5.2% of the total transport.
domestic freight transport. Fuel constituted the highest volume (20 million tons or 88% of the overall coastal transport) followed by metal for construction (1.6 million tons, i.e., 7% of the total coastal transport) and the rest was fertilizer, chemical, rubber tree, and bagged cement.

The sea transport is key function in Thailand’s economic development, because this is the principle mode of transport for the international trade of the country. The important international ports in Thailand are operated by the government, and coastal ports are owned by the private sector. In 2005, the container volume through ports was 5.6 million twenty-foot equivalent units (TEUs) and this mode of transport is rapidly increasing.

Regarding air transport, there are three types of freight airplanes: passenger flight, combi-flight, and charter flight. The main commodities of air transport are computer parts and accessories, electric equipment, precious stones and jewellery, fresh fruits, and vegetables. At this time, there are 31 registered air freight transport operators with the leader of air freight transport as Airports of Thailand Public Company (AOT), previously “Airports Authority of Thailand”. In 2005, the volume of air freight transport was 1.2 million tons, having the Bangkok International airport as the main airport with volume around 1.13 million tons or 94% of the total air freight transport, followed by Chiang Mai, Phuket, Hat Yai, Chiang Rai airports, respectively, which also had the most domestic air transport between these five airports.

The limited developed mode of transport is pipeline, which has the capacity of the 66,000 million litres/year of gasoline. There are two pipelines and both of them are running at low level of performance, THAPPLINE Co. Ltd. approximately at 32% and FPT Co. Ltd. approximately at 36% of their respective capacities.

The operation of various terminals is as per their objectives. The truck terminals at present are operating at 75-85% level of space occupancy though they are basically used as storage of goods and truck services, but not rightly used as collection and distribution centres. The off-dock container freight stations and inland container depots are among terminals of high demand and their utilization is high though they also have not so far played the role of efficient logistics centres, including customs clearance services as expected, rather heavily used for checking and loading goods for export and import and storing cargos and containers.

### 3.3 Fundamental Transport Problems

Despite all the development of transport and terminal infrastructure which seems well developed in general, the Thai Government has identified and acknowledged that there are still several inherited problems hindering all modes of transport. In general, the key problems and threats of road transport are the traffic jam in Bangkok and its vicinity caused by still limited infrastructure network, overloaded trucks, insufficient facilities, and truck restriction measure. The major problems and threats associated with railway transport are the deteriorated lines, main tracks limited to single track, too many rail grade-crossings or level-crossings, and insufficient trains.

Similarly, the major water transport problems can be considered as empty lighters could not pass through the Nonthaburi Bridge in the flood season, the private ports are insufficient, the water level in the Mekong River is shallow during dry season, and high international port service fees don’t encourage lighters. Furthermore, problems and obstacles of coastal freight transport are numerous as well. The major one are, for example, the priority of coastal transport is low when anchor at the Laem Chabang port, coastal ships and vessels have to pay
for anchor charges in the same range of seaports, intermodal transport that is connected to this mode is still not in the state of high efficiency due to the lack of interfacing, and most port channels are shallow. The major problems and obstacles hindering air freight transport in Thailand are the congestion of warehouses space in the airports of Thailand, no air freighters, and the limitation of refrigerated rooms or cold storages.

3.4 Ongoing Transport and Terminal Plans that Help Ease the Present Problems
To cope with the overall problems associated with transport infrastructure, the Government has devised future plans, basically short-term on all modes, which according to the analysis of the Government will solve in a great extent; and a smooth, efficient and economic transport and logistics services would be possible. The following are the major road infrastructure development and improvement plans.

i. Inter city motorway project that would connect existing roadway network systemically which can help to distribute development benefits to the provincial areas, relieve traffic congestion problem in a long term basis, and decrease travel time and cost.

ii. Bangkok and outskirts expressway project to increase motorway network for supporting traffic growth and ease traffic volume from roads in Bangkok and its outskirts.

iii. Industrial ring road project to connect the Phra Pradaeng Industrial Estate, the Phu Chao Samhing Phray Industrial Estate and the Bangkok port together.

iv. Four–lane highway widening project to improve state of highways, which connect Bangkok and other important provinces for increasing transport capabilities.

v. Roadway network connection with neighbouring countries to integrate the domestic road network with those of the neighbouring counties and to promote provinces as the centre of land transport.

In the present state of railway transport development, the following railway transport plans are considered significant to ease the present level of problems and open up for gradual improvement.

i. National double track partial construction of 801 km railway line in all congested sections.

ii. Double track construction in the East Coast railway (Khlong Sib Kao-Kang Koi-Chachoengsao and Chachoengsao-Sriracha -Laem Chabang) to increase the capacity and efficiency of the East Coast railway in order to support the growth of commodity transport, especially from the expansion of the Laem Chabang port phase II.

iii. Railway maintenance phase IV, V, and VI to maintain tracks and bolsters (timber type) in order to be used as usual.

iv. Supplement of 13 locomotives and 284 container bogies to increase the services of internal container bogies (full train) from the North, Eastern and Southern regions to waterway stations and the Laem Chabang port.

v. Rail tracking system to be able to support more containers that are shipping through the Laem Chabang port.

The plans for inland waterways and port development are as follow.

i. Construction of public inland water transport ports and stations at Ang Thong and Phra Nakhon, Sri Ayutthaya provinces to promote the usage of energy efficient waterway transport system.

ii. Chiang Saen development to develop a special economic border zone at Chiang Rai province facilitated by the agreement of water transport route in the Mekong River as a centre of collecting goods from Northern, North-eastern and Central regions of
Thailand to promote inland water transport-based trade with China.

iii. Khlong Yai multi-purpose port construction project in Trat province with the objectives of developing eastern Coast as a gateway and linking neighbouring countries.

iv. Port development at Chumphon province to link upper Southern and Eastern regions with western coast by ferry.

v. Multi-purpose port development in Ranong province to become one of the major international ports on the Andaman Sea coast with a view to promote trade with BIMSTEC and GMS-EC.

vi. Don Sak multi-purpose port maintenance project in Surat Thani province to connect transport network for sea freight and passenger transport at the East coast between Koh Samui, Ang Thong archipelago and the Gulf of Thailand coast.

vii. Pak Bara deep sea port development to place it as a gateway on the Andaman Sea coast including Andaman Sea, Gulf of Thailand, and East coast to link the sea transport centre to South Asia, Middle East, and Europe.

viii. Second Songkhla deep sea port development to support international trade which has its rapid growth trend and increase port capability at lower Gulf of Thailand coast.

The Government has the following plans to improve air transport infrastructure and operation.

i. The development of Chiang Mai and Phuket airports as the aviation centre in respective regions.

ii. The container service area expansion project of the major international airports in order to expand the services to other capital cities around the world.

iii. Promotion of freighter charter flight to increase the competitive capability during high demand seasons and in busy routes.

iv. Increasing supplementary freighter services to strengthen freighter services capabilities by modifying the two MD-11 aircrafts.

v. Establishment of Perishable Goods Logistics Centre for Asia to provide the preservation services for both the quality and freshness, and internal distribution services.

vi. Establishment of Express Logistics Centre to provide storage, distribution and custom clearance services in international airports.

Regarding pipeline infrastructure, at present, the Government has two pipeline transport expansion projects: (i) Saraburi-Nakhonsawan–Pitsanuloke–Lumpang; and (ii) Saraburi-Nakhonratchasima-Khonkan. Also, the Government had approved the third master plan of natural gas pipelines system in 2005 for supporting nature gas demand expansion.

At present, the Government has no exact plan revealed for the development of transport and logistics terminals. As the participation of the private sector is increasing in the transport infrastructure development they can be developed as and when need is felt as well as the private sector assesses profitable of developing any of such a terminal.

3.5 Creation of Transport and Economic Corridors and Network

Thailand as part of its highway and railway network development has conceived two vital corridor development: north-south corridor and east-west corridor, also along the Asian Highway and Trans-Asian Railway networks. These corridors not only connect all bordering countries, but also create economic corridor as well. The north-south economic corridor is the main network that links Southern China, Myanmar, Laos, Thailand and Malaysia together. Almost all of the main highways of Thailand in this corridor have been upgraded
to 4-lanes. The Department of Highways has planned to extend Highway No.103 to connect the Asian Highway routes AH13 and AH2 in order to reduce the distance of north-south economic corridor. The highway route R3E that links China to Houayxai (Laos) has already been upgraded and a new bridge crossing the Mekong River to Chiang Khong is needed in order to link into Thailand and a bridge is being constructed in Chiang Khong district of Chiang Rai province, at Ban Don Mahawan. Once the special highway is constructed linking Chiang Khong, Chiang Mai and Phitsanulok to the Bangkok-Chon Buri motorway and Laem Chabang port, the capability of Thailand in efficiently handling of international trade and transport would be significantly enhanced.

The east-west economic corridor is the secondary corridor that links Myanmar, Thailand, Lao PDR, and Vietnam. At present, construction of the second bridge crossing the Mekong River at Mukdahan has been completed sometimes ago. Part of the route in Thailand has now been expanded to a four lanes, while parts of the Highway Number 9 in Lao PDR and Vietnam have been upgraded to a higher standard. In addition to the development of several highways in Thailand, the Thai Government is also helping the neighbouring countries in basically completion of missing links and construction of the trunk routes through approximately seven billion baht budget and technical assistance to 16 projects.

In relation to railway network, the aforementioned economic cooperation programs have resulted in the conceptual trans-Asian Railway links, of which the key sections supporting the development of the Hexagonal economic area are: Route A – Kunming – Jinghong-Muang La-Luang Nam Ta-Houayxai-Chiang Rai-Denchai, and Route B – Kunming-Jinghong-Muang La-Luangphrabang-Vientiane-Nong Khai.

To materialize the concept of economic corridors and network, the location of industrial estates should be seen as a foundation. Currently, there are 34 industrial estates, distributed across 14 provinces, controlled and managed by the Industrial Estate Authority of Thailand (IEAT). However, those industrial estates are though mainly spread over Highway No. 1, 3 and 4 they are largely concentrated on the Bangna-Trad road and Chonburi and Rayong provinces. Also, the additional estates are closely located to the international seaports, such as: the Laem Chabang port, Sriracha Harbour, and Map Tha Put port.

The development of domestic basic infrastructure should not only be considered for its sufficiency, but also it should be considered for the facilitation of multimodal transport with neighbour countries too. Thailand has good capabilities and better conditions in this regard. For example, the national road network can be used to transport cargos across Lao PDR, Cambodia, Malaysia and Myanmar, thereby extend to Vietnam and Southern China.

4. NON-PHYSICAL ENVIRONMENT

4.1 Development and Enactment of Multimodal Transport Legislation

for its international trade. There is so far no specific law that governs the total multimodal transport operation that is applicable to both in the national and international territories rather different laws like the Thai Civil and Commercial codes would be applied for liability regimes and Land Transport Act for governing freight forwarding among others.

Though development of the Multimodal Transport Act was initiated since 1997 along with the ASEAN Framework Agreement on Multimodal Transport, both the provisions have been completed only in 2005. The Framework has been signed in November 2005 and the Multimodal Transport Act of Thailand has been passed by the Parliament. However, the regulations are still in preparation and the enforcement of the Law has not been effective yet. Moreover, in the near future, Thailand is set to enact legislation addressing multimodal transport, which will be applicable to both domestic and international multimodal transports. This is exactly in par with the ASEAN Framework Agreement on Multimodal Transport, which is the model law for application among ASEAN countries. Thus, there will be the same language spoken among ASEAN members while doing international trade. The legislation has introduced the main principles that the multimodal transport operator is the only person who should be liable for loss, damage or delay, no matter how many carriers take part in the transport. Furthermore, the legislation has provisioned precisely the multimodal transport document, liability of the multimodal transport operator, liability of the consignor and claim for compensation. This should enhance the smooth functioning of communication, documentation, transaction, inventory, and payment.

4.2 Communications and Documentation
To speed up and facilitate the flow and movement of legitimate cargo, the Customs Department provides two clearance systems: manual and electronic data interchange (EDI). The documentation to be submitted for import or export is quite clear. Thailand has already entered into a full-fledged electronic data interchange and electronic commerce applications and now port procedures are computerized, customs procedures are computerized, traders can input data electronically both port and customs electronic data interchanges, all parties are electronically linked and electronic trade in transport services is accepted. Yet single document, single-window and single-stop inspection system is more cosmetic than the functional in all types of import and export and for small and medium enterprises.

5. ASSESSMENT OF TRANSPORT INFRASTRUCTURE AND OPERATIONAL PROVISIONS CONducive TO MULTIMODAL TRANSPORT AND LOGISTICS SERVICES

Thailand has done remarkable progress towards a competitive, efficient, and economic transport development and operation along with logistics services development to perform efficient domestic production and distribution system and competitive international trade. However, the preparedness does not seem to the par, compared to other developed countries as well as if also assessed against some desirable indicators in terms of modal development and operation.

5.1 Preparedness and Actions for Domestic Transport and Logistics Services
The logistics cost, which is a total cost of inventory management, transport and administration, is calculated by different scholars between 15% and 19% of the total sales which is quite high compared to Japan and even countries like Taiwan, Korea and India. Such logistics costs to GDP has been calculated by NESDB and presented in table 2. It is clear that
the logistics costs per GDP in Thailand in not only high but also there is no clear trend that it would decline shortly, particularly the inventory holding cost is increasing slightly.

Table 2 Logistics costs to GDP 1999-2007

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Transport Cost</td>
<td>9.7</td>
<td>10.1</td>
<td>9.9</td>
<td>8.8</td>
<td>8.4</td>
<td>8.0</td>
<td>8.5</td>
<td>8.8</td>
<td>8.7</td>
</tr>
<tr>
<td>Inventory Holding Cost</td>
<td>7.9</td>
<td>8.1</td>
<td>7.9</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
<td>8.1</td>
<td>8.6</td>
<td>8.5</td>
</tr>
<tr>
<td>Logistics Administration Cost</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>1.6</td>
<td>1.6</td>
<td>1.6</td>
<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Total Logistics Cost</td>
<td>19.4</td>
<td>20.0</td>
<td>19.6</td>
<td>18.1</td>
<td>17.7</td>
<td>17.3</td>
<td>18.3</td>
<td>19.1</td>
<td>18.9</td>
</tr>
</tbody>
</table>


For a limited but major commodity groups the total logistics cost varies between 6.2% of the total sales value for seafood and as high as 19.1% for fertilizer, mineral products and cement followed by agricultural products (19.0%).

When broken down by the major components of transport, inventory management and administrative costs, the major share occupies by transport cost (see table 2) which ranges between exceptionally low value (0.5%) for high-value goods like medical tools and equipment, electronic circuit boards and jewellery, followed by seafood (2.43%) and 14.96% for relatively low-value bulky commodity group of fertilizer, mineral products and cement. In other words transport cost constitutes in a range of less than 10% to about 80% of the total sales depending upon the commodity nature. The inventory management cost, which basically comprises of terminal and transfer costs, occurs as low as 0.89% of the sales for seafood which is about 15% of the total logistics cost, and as high as high as 10% of the sales for agricultural products which is 52.6% of the total logistics cost. Similarly, the administrative cost, which basically comprises the information, order processing, costumer services and assorted, is found ranging between 1.07% for the relatively low-value bulky commodity group of fertilizer, mineral products and cement which is 5.6% of the total logistics costs and 8.7% for rubber, paper and wood furniture group which is 52.6% of the total logistics costs. However, the highest proportion of administrative cost is observed for high-value commodity group of medical tools and equipments, electronic circuit boards and jewellery (78.1%). Other commodity groups with high administrative cost in total logistics cost are fresh orchids (50.9%); computers, components and electric transformers (50.9%); textile, woven goods and synthetic fibre (44.1%); and raw chemicals, plastic products and tires (43.3%).

The above presented facts and figures though do not exactly delineate the position of Thailand, they indicate that there are some unnatural major components (inventory management, transport and administrative) costs caused by either incomplete, incompatible, under facilitated transport and terminal networks that is a low level of multimodal transport and logistics services development.

This paper has assessed the status of transport and terminals in Thailand compared with the level of Japan, Taiwan and Korea as information available and applicable. The most common indicator is the road density and a one km of road length per sq km of area in average can be considered as desirable. Japan has already achieved this as its road density is 2.45. Similarly, Taiwan has just achieved the level in terms of both total road length and paved road as the respective densities are 1.07 and 1.0. Both the countries can be considered in their high level of road development. Such density for Thailand is only 0.35 for total road and 0.17 for paved road development. Thus, Thailand may be considered as moderately developed in road
network, which still cannot efficiently facilitate the smooth transport of goods throughout the country with the least distance travel incurring least transport cost particularly for the local level.

The rail development density if compared to Japan and Taiwan is far less developed as its density is just 0.008 whereas their respective densities are 0.062 and 0.067. In this regard, the railway development in Thailand is even considered underdeveloped. Thus, high level of competitiveness and efficiency cannot be expected from such development. Furthermore, despite a long-time commitment and plans to a significant modal shift particularly from road to rail in domestic land transport, it has been clear that the share of railway transport has not been significantly increased over road as it can be seen from table 1 that the share of road transport in handling domestic freight is well above 87% and the share of railway is less than 3% over the years.

If a port per 500 km coastline is taken as a desirable port density, Thailand does not have an extensive port development which could be work as gateways and break-of-bulk point as well promote economic activities across coastal region. In this regard, though the port density in Thailand is higher than in Japan and Thailand has the 19th largest port in the world, it is far behind than Republic of Korea and Taiwan.

Thailand is moderately developed in terms of airport development if one paved airport per 10,000 sq km of area is taken as an easily accessible airport density. The density is far behind of Malaysia, Republic of Korea or Taiwan; and less than half of Japan.

So far the transport terminals are concerned, all types of terminals are far behind of a desirable density at this stage of economic development and the need for efficiently facilitating some sort-rang of hub-and-spoke type of inventory management. All terminals of high significance for logistics services, namely, dry ports and/or inland container depot, truck terminals, container freight stations, container yards, warehouses, cold storages and silos are firstly much fewer than expected, and secondly most of them are concentrated in and around Bangkok and its vicinity followed by the eastern industrial corridor. For example, if a truck terminal is established in a radius of 100 km and a population of 2.5 million, there should be 21 truck terminals in the country. The only three truck terminals in the outskirts of Bangkok though are of great significance, rest of the country remains out of the reach of truck terminal services, which is rather expected to serve a localized hub-and-spoke logistics services. A true dry port even does not exist in Thailand and similar to the situation of truck terminals is the situation of all other terminals.

5.2 Non-physical International Transport and Logistics Preparedness and Actions
Thailand is working under four specific sub-regional and regional initiatives on the issues of transport and logistics concerning cross-border trade. The cross-border trade between Thailand and its bordering countries has rapidly increasing over the last 10 years as a result of intensification of these sub-regional and regional initiatives. Thus, it has over the years heavily involved in sub-regional initiatives. They are Association of Southeast Asian Nations (ASEAN), Greater Mekong Sub-region (GMS), Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMESTEC) and Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS). In all initiatives, transport is one of the core issues. In this connection, the transport policies and regulations in particular have been taken as the means to strengthen bilateral, sub-regional, and regional trade and tourism development, along with ASEAN transport policies and GMS initiatives. Particularly,
ASEAN member countries since 1980s have entered into a series of agreements relating transport and facilitation, namely the Agreement on the Recognition of Domestic Driving Licences issued by ASEAN countries, 1985; the ASEAN Framework Agreement on the Facilitation of Goods in Transit, 1998; the draft ASEAN Framework Agreement on the Facilitation of Inter-State transport, the Agreement on the Recognition of Commercial Vehicle Inspection Certificates for Goods Vehicles and Public Service Vehicles issued by ASEAN member countries, 1998; and the ASEAN Framework Agreement on Multimodal Transport, 2005. Similarly, Thailand has already signed the Greater Mekong Sub-regional Agreement for Facilitation of Cross-border of Transport of Goods and People.

As discussed above, the ASEAN Framework on Multimodal Transport has become the reference for the development of multimodal transport in the country though it took almost a decade to get through. Similarly, the GMS Cross-Border Transport Agreement (CBTA) has been very successful in implementing single-window customs clearance at all border crossing in GMS. Specifically, Mae Sai-Tachilek border-crossing point is one of the seven pilot points selected under the CBTA, which came into force in 2003 to streamline regulations and reduce non-physical barriers by introducing a single point inspection and single-window customs clearance. All other six GMS border points have become operational now. Along with cross-border transport agreement, the Government has principally accepted and action is undertaking in (i) facilitation of border crossing formalities, particularly the single-window customs clearance, single-stop inspection, coordinating of hours of operation, and exchange of advance information and clearance; (ii) facilitation of cross-border movement of people (multi-entry visa, recognition of driver license); (iii) facilitation of cross-border movement of goods; (iv) exchange of traffic rights; and (v) requirements of admittance of road vehicles; among others.

However, the cross-border trade and transport are not easy like that and the following physical impediments have been encountered.

- There are still missing linkages of transport in some critical sectors;
- Some bottleneck have been created due to inadequate transport infrastructure;
- Terminals have been inadequate as they could facilitate storage in the border area;
- The industrial establishments have not been developed along the physical corridors as expected and there are virtually less products to export;
- Transport carriers are not at their state of the art technology.

Moreover, non-physical impediments are more prominent than physical impediments in obstructing the increased cross-border trade.

- In particular, regulatory impediments are more acute than any other impediments as legal and regulatory framework for trade, such as import licensing, is largely primitive or restrictive in most bordering countries;
- There is the difference in level of development between Thailand and its neighbouring countries which causes mismatch of interest among countries and efforts are put to protect domestic market;
- Customs is not efficient;
- Stop and inspection require more time that actual operational time;
- Trained human resources is a great hindrance;
- Total transport and logistics costs are still high.

In regional and global initiatives, Thailand has participated but perhaps not proactively prepared and put into action though it is actively participating in the most important Asia and
Pacific regional transport initiatives – the Asian Highway and the Trans-Asian Railway by signing in both the agreements. Now, at regional and global level, there are over 120 international conventions. The Economic Commission for Europe (ECE), the body designated within the United Nations system with responsibility for land transport conventions, is promoting over 50 conventions of which Thailand has signed only five, including ratification of three conventions. Similarly, the International Maritime Organisation (IMO) has initiated about five dozen conventions and Thailand is a signatory of only a dozen ones.

At regional level, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) in 1992 adopted Resolution 48/11 on road and rail transport modes in relation to facilitation measures, which recommended that countries in the region should consider acceding to seven international conventions in the field of international land transport facilitation as a cost-effective prerequisite step towards enhancing road and rail transport routes throughout the region and promoted a selected seven conventions. These include: (i) Convention on Road Traffic, 1968; (ii) Convention on Road Signs and Signals, 1968; (iii) Customs Convention on the International Transport of Goods under Cover of TIR Carnets (TIR Convention), 1975; (iv) Customs Convention on the Temporary Importation of Commercial Road Vehicles, 1956; (v) Customs Convention on Containers, 1972; (vi) International Convention on the Harmonisation of Frontier Controls of Goods, 1982; and (vii) Convention on the Contract for the International Carriage of Goods by Road (CMR), 1956. Though, Thailand had already acceded two conventions before the adoption of Commission Resolution, it has not acceded the remaining five afterwards. This status on the regional and global initiatives on transport conventions shows that Thailand has rather chosen the ASEAN and other sub-regional initiatives to proceed ahead on the issues of international transport conventions and agreements, including the much needed United Nations Convention on International Multimodal Transport of Goods 1980.

### 5.3 Logistics Performance

Having analyzed the physical and non-physical preparedness and actions taken by Thailand, based on data, a logistics performance indicators for Thailand has been presented in table 3 which clarifies its position.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Overall</th>
<th>Developed countries</th>
<th>Asian countries</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure</td>
<td>2.58</td>
<td>3.85</td>
<td>2.53</td>
<td>3.16</td>
</tr>
<tr>
<td>Customs</td>
<td>2.56</td>
<td>3.64</td>
<td>2.52</td>
<td>3.03</td>
</tr>
<tr>
<td>International shipment</td>
<td>2.72</td>
<td>3.66</td>
<td>2.70</td>
<td>3.24</td>
</tr>
<tr>
<td>Logistics competence</td>
<td>2.71</td>
<td>3.83</td>
<td>2.70</td>
<td>3.31</td>
</tr>
<tr>
<td>Tracking &amp; tracing</td>
<td>2.73</td>
<td>3.89</td>
<td>2.68</td>
<td>3.25</td>
</tr>
<tr>
<td>Domestic logistics costs</td>
<td>2.90</td>
<td>2.47</td>
<td>2.91</td>
<td>3.21</td>
</tr>
<tr>
<td>Timeliness</td>
<td>3.17</td>
<td>4.16</td>
<td>3.11</td>
<td>3.91</td>
</tr>
<tr>
<td>LPI index value</td>
<td>2.74</td>
<td>3.83</td>
<td>2.70</td>
<td>3.31</td>
</tr>
</tbody>
</table>

Source: Values to calculate the mean were taken from [Arvis, et al., 2007](Arvis, et al., 2007), pp. 26-33.

Despite the aforementioned problems and complications, Thailand is a world player in the field of transport and logistics. Its performance is better than the overall performance in the world as well as better among Asian Countries. However, except domestic logistics costs Thailand's performance is not better the developed countries.
6. FRAMEWORK FOR A FUNCTIONING MULTIMODAL TRANSPORT AND LOGISTICS SERVICES

There are three steps to be taken for a functioning multimodal transport and logistics services that can cope with the demand of the globalization and free market trade for Thailand. The first one is the maximum utilization of the existing transport infrastructure network, terminal facilities, and non-physical transport and logistics services channels: communication and information technology and extended banking and financial network.

The second step is the completing missing links, creating short cut routes, and de-bottlenecking in the possible shortest term. The efficient multimodal transport depends upon not only the transport network, but also upon the interfacing of different modes. Currently, some of them are not functioning properly. Similarly, present level of transport efficiency can be increased by de-bottlenecking in infrastructure by increasing routes capacity, enhancing route physical stock, decreasing intersections among road-crossings and between road and railway crossings, and increasing construction efficiency among projects which have been already undergoing and presented in detailed in Section 3.5. Human resources development is another area where well-prepared short-term training can enhance the capacity of the lower and medium level technicians and professionals to a certain extent to handle the multimodal transport and logistics services both in the government and the private sector, a well covered degree programs and non-degree training programs should follow immediately.

Though an advanced communication-documentation channel seems intact at well advance stage, it is, however, not common among small and medium enterprises. A starting point is the creation of an association of the small and medium enterprises to develop and facilitate a communication-documentation channel with consorted effort.

Today, logistics services development in Thailand faces legal problems that hold back practices. Thailand has experienced legal and regulatory problems which do not support logistics services as expected. Primary and secondary laws do not exist yet to support and develop logistics services. Existing laws create obstacles to such development and should be amended as outlined below.

- Lack of laws for institutional establishment which would be a juristic council of logistics providers in order to supervise and unite the country’s logistics system.
- The International Road Transport Bill which has been enacted, now has to properly and smoothly function as its spirit.
- Laws related to truck height and weight should be revised to match an international standard.

Another factor that supports multimodal transport system is advanced technologies without which the expected competitiveness, efficiency and economy cannot be achieved. The efficiency of IT by electronic data interchange (EDI) system will replace manual customs system in the future and this will create information linkage between organizations via electronic means. Other technologies to support efficient logistics services should be adapted in their complete forms.

- Container inspection system by container security initiative (CSI) and 24-Hour Rule measure.
- Tracking system demonstration and prevention of international maritime transport terrorism through Radio Frequency Identification (RFID) Technology via E-seal and the Global Positioning System as its utmost applicable.
• Intelligent transport system i.e. ITS applies information, communication and computer technologies to transport services in both passenger and freight sectors

Organization and human resources are important elements in compelling efficient multimodal transport. The concept of organization development involves developing organizational strength in logistics field, creating connection between organizations, defining responsibility clearly, creating development machinery, reducing top-down management, and promoting the private sector to join and share operation and development. The technicians and professionals should be provided with logistics education in term of both quality and quantity to meet the demand of the industry, especially in supply chain management groups by concentrating on the development of knowledge, skill, and institution building.

At this time, there is not a central database system for planning and management. In order to achieve the efficient multimodal transport development and operation, database must be reliable and up-to-date. Database comprising import-export statistics, commodity flows, origin-destination transport statistics, and logistics nodes must be developed based on Management Information System (MIS) and Geographic Information System (GIS), and access be granted through internet and intranet.

The third and final step is to develop a comprehensive national development plan like that of Japan under which the above identified network deficiencies can be overcome in a shortest period of time. In the area of infrastructure development there is the need to almost double or even three or four folds in roadways, railways, seaports, and particularly various terminals and industrial estates with the provision of fully functional logistics centre. What is particularly important in this long-term planning that the infrastructure, terminal and production locations must be deconcentrated and decentralized in a population-area size combined geo-space.

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