
Integrated Evaluation of Intermodal Logistics System

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Abstract

Owing to the recent development of horizontal international division of labour and emerging new consumer market, it becomes more important for the private sector to manage door-to-door supply chain efficiently, and for the public sector to provide key infrastructure for intermodal logistics system. However, there is no common framework to evaluate intermodal and international logistics system from both private and public sector viewpoints. This chapter proposes a planning framework with performance indicators to understand, assess and improve the present and changing conditions of logistics systems, and introduces examples to evaluate alternative intermodal logistics systems in the region.

Keywords: Logistics policies, intermodality, integrated evaluation, performance indicators

1. Intermodal logistics to support Asian economy

Asian countries have intensified their efforts to liberalise their economies under the Free Trade Agreement (FTA) such that the five founding member countries of ASEAN¹ have reduced the tariffs of 99% of their products to the 0-5 percent range, and which all member countries are expected to comply by 2015 to realise the objectives of the ASEAN Economic Community. Moreover, China has begun bilateral and multilateral liberalisation trade talks that bolstered the region's momentum towards economic integration. If tariff barriers are to be eliminated just like in the European Union (EU), international division of labour would be further developed. Each company can then source/distribute raw materials and components from/to the right places without attending to each country's borders, and can sell its products to the right places in order to maximise the economic benefits of production and distribution.

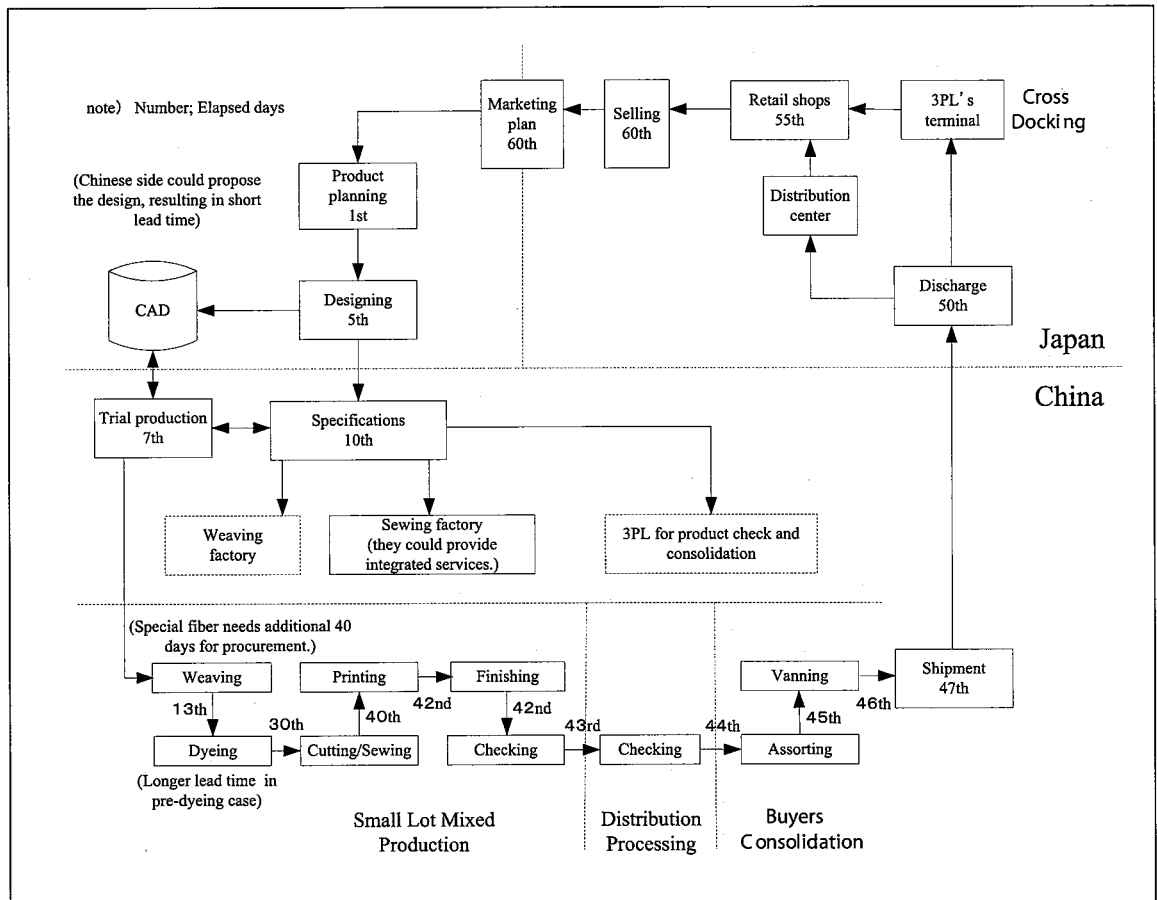
Foreign direct investments to Asia have been increasing ever since horizontal division of labour became the norm. This present situation no longer divides the processes thus, full-scale overseas production is adopted and products are sold locally. This is not the case before when vertical division of labour was the practice, wherein components were brought and products were assembled in China and Southeast Asia and then exported to Europe and the United States. Furthermore, the technical capabilities of local industries, like in the electronics and machinery or automobile, have improved. The development of a new system provides for components that can now be mutually obtained among countries.

In the midst of on-going advances in the horizontal division of labour, it is important for each company to manage the entire supply chain spread across Asian countries with more efficiency in terms of cost and the environment. In addition, freight transport has intrinsic differences such that high-value added components require delicate handling and low-value added components do not become obsolete. In addition, logistics needs of companies have become diversified as manifested by various choices of allowable lead times, and diverse selection of intermodal transport services.

¹ On August 8, 1967, the Foreign Ministers of Indonesia, Malaysia, the Philippines, Singapore and Thailand jointly agreed to the establishment of an association for regional cooperation among countries in Southeast Asia, which would later be known as the Association for Southeast Asian Nations (ASEAN).

The apparel industry, for example, introduces advanced intermodal logistics systems, including “buyers’ consolidation” and “cross docking” schemes.

In Figure 1, apparel products are assorted and packed into a container destined to a consignee’s nearby port (buyers’ consolidation). Just after arrival at the port, the container is brought to the 3PL’s freight terminal and all products are de-consolidated and directly transported to the retail shops operated by the consignee (cross docking).



Source: T. Nemoto, S. Ishihara, M. Hashimoto and K. Hayashi (2007)

Figure 1. Supply chain management in apparel industry

Fortunately, because Asian countries are surrounded by bodies of water, they have focused their efforts on port improvements which are expected to enhance the convenience of port-to-port transportation. However, much has to be desired concerning door-to-door transportation. First, problems on cross border procedures exist such that it takes a long time to finish customs clearances, and export and import procedures remain cumbersome, complicated and expensive. There are also several countries that have problems with poor road infrastructure, especially access roads to ports. These problems prevent the efficient entry and exit of marine containers and are major causes of traffic congestion. Likewise, Asian countries do not make full use of their railroads and trucks in cross border transportation. For example, both origin and destination countries still require immigration controls, customs and quarantine procedures when crossing the border by truck. Cargo freight is subsequently transferred or transhipped into a truck operating within the country due to regulations on business licenses and vehicle registration.

2. Multi-policy planning framework using multi-objective indicators

Although private companies are trying to optimise their intermodal and international supply chain, governments are not necessarily equipped to evaluate their logistics policies with such broad perspectives. In the previous report done by the Asian Task Force (2003), logistics policies in Asian countries were reviewed, and it was found that mode-specific transport policies are still dominant. Many countries seem eager to build hub-ports or hub-airports but their intermodal connections are areas that have not been fully explored. Furthermore, it is difficult to evaluate the international logistics system since Asian countries have just started discussion on international and cross border issues in the course of FTA/EPA development in the region and in the round table set by international organisations such as ASEAN, UN-ESCAP and ADB.

Intermodal and international logistics system should be evaluated and planned in a more integrated manner. In the current planning of logistics system, a ‘single-policy’ is being evaluated using a ‘single-objective’ approach. It is proposed that such be replaced by an integrated evaluation system of ‘multi-policy’ with a ‘multi-objective’ approach. In the new planning framework, alternatives of intermodal and international logistics system (multi-policy) and performance indicators (multi-objective) should carefully be defined, and evaluation of which multi-policy would satisfy which multi-objective can be done through observation/comparison of the existing practices in the real world or by computer simulation analysis with an evaluation model built in the virtual world (evaluation). Figure 2 illustrates this new planning framework, while Table 1 and 2 show the examples of multi-policy and multi-objective approach, respectively.

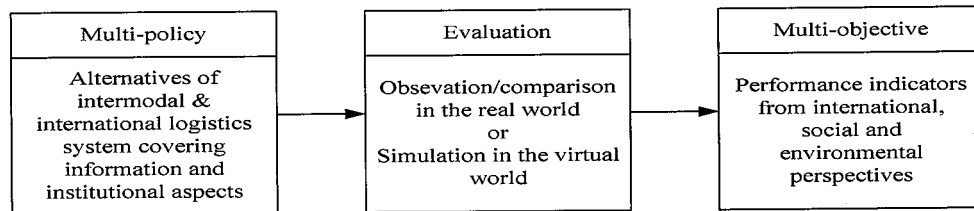


Figure 2. New planning framework of multi-policy by multi-objective

Table 1. Towards multi-policy logistics system

Single-policy	Multi-policy
Single mode policy (e.g. road improvement)	Intermodal policy (e.g. road and port connectivity)
Domestic policy (e.g. vehicle weight limits, subsidy to clean vehicles purchased by small trucking companies)	International policy (e.g. standardised vehicle weight limits, harmonisation of vehicle related charges and subsidies)
Independent infrastructure policy (e.g. physical infrastructure development: hub-port development)	Integrated infrastructure policy covering physical, information and institutional infrastructure (e.g. platform for intermodal seamless bonded container transportation)

Table 2. Towards multi-objective performance indicators

Single-objective	Multi-objective
Project-based performance indicators (e.g. road length newly constructed)	Outcome-based performance indicators (e.g. lead time from order to delivery, environmental soundness, security, seamlessness)
National benefit (e.g. GDP per capita)	International benefit as well (e.g. reducing green gas effects)
Particular interest group’s benefit (e.g. carriers’ profit)	Social benefit and disadvantageous interest group’s net benefit as well (e.g. social net benefit, maximising benefit of the most disadvantageous)

The multi-objective approach measures the result not by project-based performance indicators, but by outcome-based performance indicators. Private companies are not interested in newly constructed roads themselves, but how much these roads would improve the lead time from order to delivery in their particular supply chain. The performance indicators can be further broken down. For example, ‘seamlessness’ of supply chain, which is one of the outcome-based performance indicators, can be further classified into 12 indicators as per findings of the OECD Task Force on Benchmarking Intermodal Freight Transport (Table 3). The task force argues that the ability to provide an integrated intermodal transport service depends largely on the compatibility of transportation equipment, the meshing of operating schedules and the extent of commonality in administrative arrangements such as invoicing and other documentation using EDI or manual methods.

Table 3. Performance indicators of the seamlessness of the supply chain

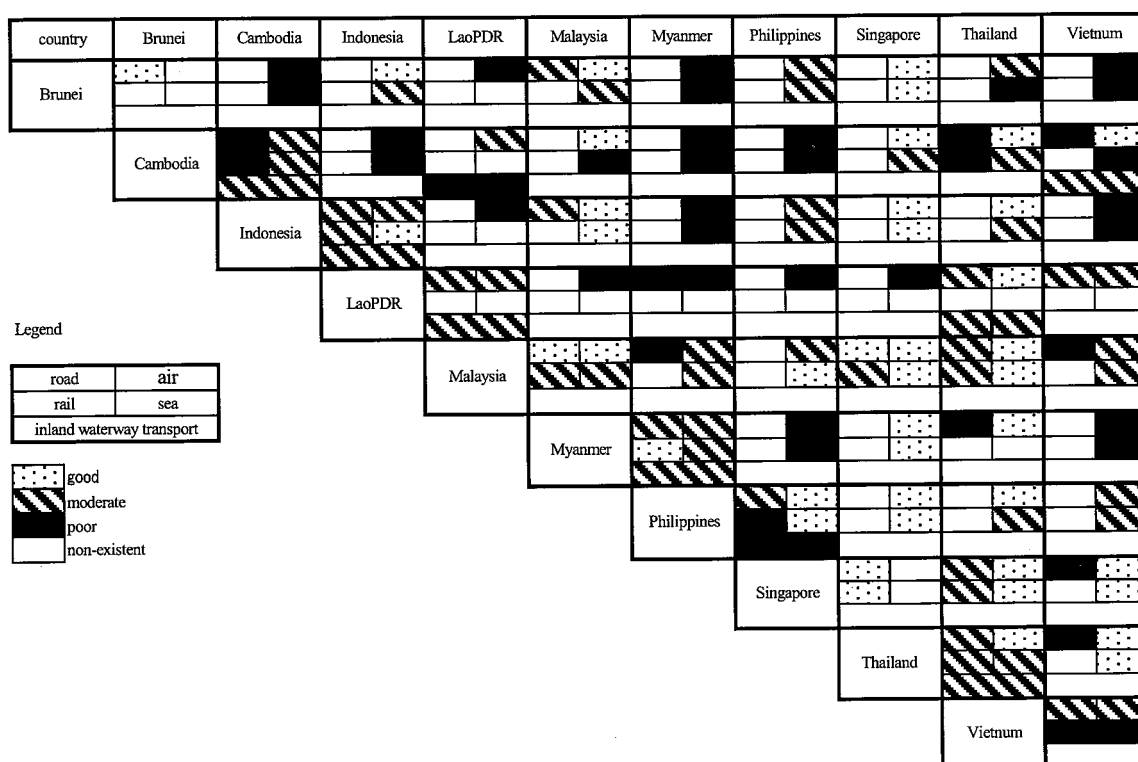
Performance Indicators	Explanation
Meshing of schedules	Measured in terms of time delays either per comparable section of the supply chain or whole comparable supply chains
Design compatibility	Measures standardisation of equipment along length of chain
Flexibility to cater for all container sizes along total length	Measures the ability of each section of supply chain to accommodate any container size; Measure of adaptability of equipment per section or entire length
Complete asset visibility	Measured by time and/or distance that container is visible (real time) over total time and/or distance
Common documentation	Measures the number of separate items of documentation required
Common EDI access to documentation	Measures the compatibility of EDI systems and the extent of access possible for each of the key stakeholders throughout the transport chain
Equitable level of security	Assesses whether all stakeholders have adequate and equitable security of cargo
Common insurance	Determines whether a single, or multiple insurance policies are required
Singular billing arrangements	As per common documentation, measures the number of separate invoices required
Singular customs requirements	Assesses whether there are singular, all-inclusive customs and other border requirements and fees
Common packaging identifications	Measures the number of items of separate identification required
Inclusive institutional acceptance of ISO standards	This would include dimensions, specifications and testing for all general purpose, thermal, dry bulk, tank, small and other sized containers

Source: OECD, Benchmarking Intermodal Freight Transport (2002)

3. Integrated evaluation of intermodal logistics system

3.1 International transport mode availability

ASEAN is conducting a series of logistics-related studies, some of which provide a good database to determine the availability of international transport modes. The Transport Cooperation Framework Plan published in 1999, examined five modes of international transport including road, air, rail, sea and inland waterway between ASEAN member countries, and rated these into three categories: ‘good’, ‘moderate’ and ‘poor’. Figure 3 shows that the levels of transport infrastructure development vary considerably among ASEAN countries. Singapore, for instance, exhibits “good” transport connections, particularly through air and sea modes, between other Asian countries, and also has “good” local road and rail transport infrastructures. Myanmar, on the other hand, mostly either has “poor” or “non-existent” connections with neighbouring countries except with the “moderate” air and sea international transport with Malaysia and the “good” air transport with Thailand.



Source: ASEAN, Transport Cooperation Framework Plan (1999)

Figure 3. International transport mode availability between ASEAN member countries

3.2 Comparison of intermodal logistics routes

ASEAN likewise conducted a case study to evaluate alternative intermodal and international logistics routes. The Vientiane-Singapore corridor was chosen to offer four routes with a variety of mode combinations (Figure 4). The all-road option gives the fastest transit time (Route B) while the road-sea combination via Bangkok port offers the cheapest transport cost (Route D).

Actual results show that almost all of the goods carried from Vientiane to Singapore were done using Route D. The road-sea route via Danang (Route A) attracts attention because it is part of the East-West Economic Corridor in the Greater Mekong Sub-region with assistance from international cooperation (ADB, JICA). The road-rail-road solution (Route C) is assumed as there

are no regular rail freight services yet.

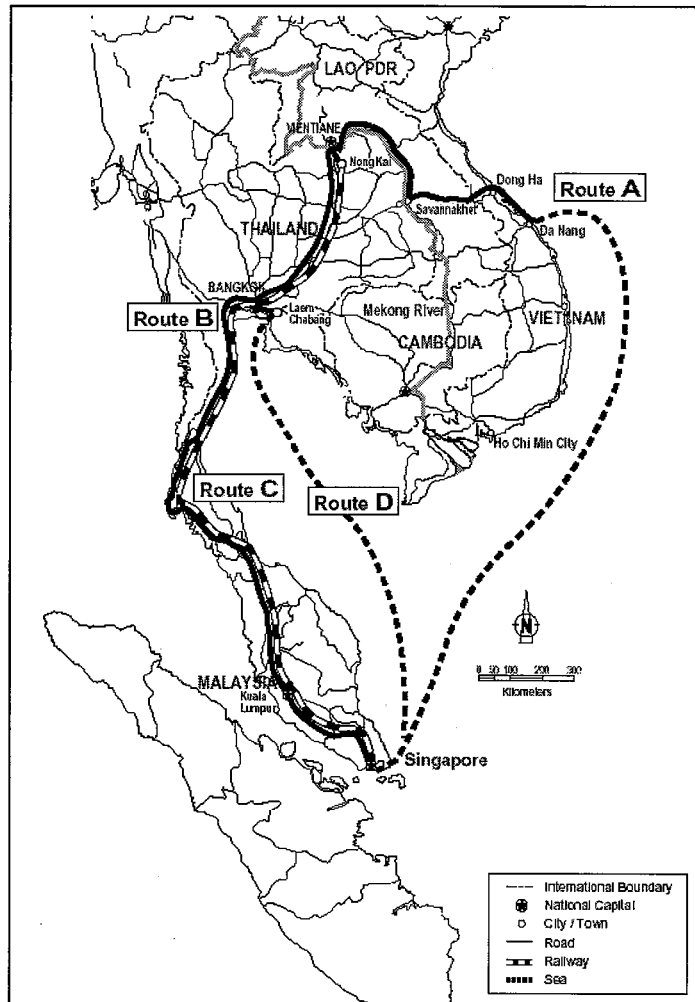


Figure 4. Alternative intermodal & international logistics routes

Alternative routes were compared in terms of ‘total transport cost’, ‘total transit time’ and ‘confidence index’. Confidence rating was based on data collected through interviews with the various stakeholders. The rating was based on a five-point type scale:

- (1) = Almost no confidence
- (2) = Not very confident
- (3) = Fairly confident
- (4) = Confident
- (5) = Very Confident

The report argues that the combination of total transport cost, total transit time and confidence index factors does explain to a certain extent why the road-sea combination via Bangkok port is the most favored route. The road-rail-road option needs to be further explored because of its higher confidence index. If the volume of cargo increases in the near future, it might be possible that the freight rates will become more competitive.

The confidence index of route A is 2.37, worst among the alternative routes. This is partly because it took more than four hours just to cross the border between Lao PDR and Vietnam

when the comparison was conducted. In 2005, however, these two countries reached a bilateral ‘Cross Border Transport Agreement’, which includes efforts towards ‘single window’ to jointly inspect passport, visa, driver license and vehicle and to impose customs duties. They are planning to reduce the time required to 30 minutes by June 2007 (ADB, 2007). In this instance, we can recognize the importance of simplification of cross border administrative procedures.

Table 4. Cost of freight, transit time and confidence index

Vientiane-Singapore	Total Transport Cost	Total Transit Time	Confidence Index
A: via Danang (road-sea)	2,150/TEU	9/10 days	2.37
B: via Bangkok (all-road)	2,139/TEU	4/5 days	2.76
C: via Bangkok (road-sea)	1,214.8/TEU	6/7 days	2.76
D: via Lad Krabang (road-rail-road)	1,549.5/TEU	7/8 days	2.82

Source: ALMEC, ASEAN Maritime Transport Development Study (2002)

4. Concluding remarks

Even as Asian countries break down trade barriers through reduced tariffs or even free trade policies to achieve full economic regional integration, much is still needed to be done to bridge certain gaps. One such challenge is in the area of intermodal logistics system, i.e., the attainment of seamless linkages – information, institutional and infrastructure-wise. Hurdles and friction costs occur primarily when there is a change of mode during a journey. This may result in higher prices, longer journeys and more delays, damage of goods and may affect the competitiveness of intermodal transport. To this extent, improving the logistical quality and efficiency of intermodal transport is a key objective.

Intermodality does not impose a particular mode option, but it is expected to contribute to an efficient and environmentally friendly logistics in the supply chain management, and should therefore be given more consideration in the formulation of logistics policies in the region. As discussed, intermodal logistics is usually international in scope, and policies cover not only physical infrastructure but also information and institutional aspects including cross border issues. As such, there is a need for each government to examine their domestic and international logistics policies all at once, and to coordinate them in order to ensure that the various modes can interoperate and interconnect.

Intermodal logistics system involves and affects many stakeholders in the countries concerned: multi-national and local shippers (manufactures, suppliers and retailers), 3PL providers, integrators, local forwarders and carriers, residents and consumers. These stakeholders have different interests so that logistics policies should be evaluated in an integrated manner openly with a variety of performance indicators. This is why we propose a planning framework of multi-policy with multi-objective.

The members of Asian task force have come to share this planning framework through a series of workshops, believing that there exist a lot of challenges for researchers and government officials. The researchers should find technical innovations to improve the efficiency and quality of intermodal logistics system by investigating best practices and by modifying them as applicable to the situation. It is also important to keep and expand the researchers’ network in order to enrich our knowledge (c.f. statistical data) on intermodality and to conduct international cooperative studies. Government officials are required to establish public-private partnership involving stakeholders to discuss logistics policy in their own country, and to set up inter-governmental forum tasked to discuss area-wide international logistics policy with the help of UN-ESCAP,

ADB, ASEAN and other organizations. International cooperation in the field of research and policy development would be helpful since the logistics issue is neither purely technical nor political, requiring a holistic approach with stakeholder participation.

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