

論文の内容の要旨

**Integrated Modeling of Asia-Wide Trade and  
Freight Transport Network and  
Its Applications to Policy Appraisal**

アジアにおける国際貿易・物流の  
統合モデル開発とその応用

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**Abstract:**

During the past decades, the global industrialization and international trade have drastically increased demands for transportation. Especially, Asian economies achieved the great development; consequently, Asia is becoming one of the biggest freight goods generations and consumptions regions in the world. Due to this reason, Asian ports are also becoming the busiest ports in the world. In terms of container handled, 20 of the world's top 30 container ports were located in Asia in 2003.

Furthermore, various economic cooperation themes in Asia are under implements and negotiations, which will definitely affect the international trade and international freight transport industry; therefore, it is very important to do the quantitative analysis of the international container transport in Asia under the various economic cooperations and integrations themes.

Meanwhile, port authorities are addressing to make the port expansions and improve the port service levels in order to satisfy the increasing demand and enhance their competitive strength. Since these projects are the very cost-consuming works, it is important to evaluate whether these policies are effective or not. On the other hand, Shipping companies are also joining the alliances and using the larger and larger containership in order to obtain the more benefit in term of the scale of economy. It is also necessary to make the effective arrangement of fleet and schedule on each shipping company's transport network.

Based on the above issues, as the objectives, this research is first to develop an integrated Trade and Freight model that could reproduce the international container cargo movements on the network, especially in Asia, which consists of land transport network and sea transport network. Then, by changing the policy variables, the model system can simulate the container cargo movement on the network under the various economic changes and technical changes. Model system is shown in Figure 1. With the stated objectives, this research identifies the following goals.

- Goal 1. Identify the problems in the international container transport industry.
- Goal 2. Develop an integrated Trade-Freight transport model.
- Goal 3. Calibrate the accuracy and applicability of our developed model.
- Goal 4. Demonstrate our model's applications to policy appraisal.

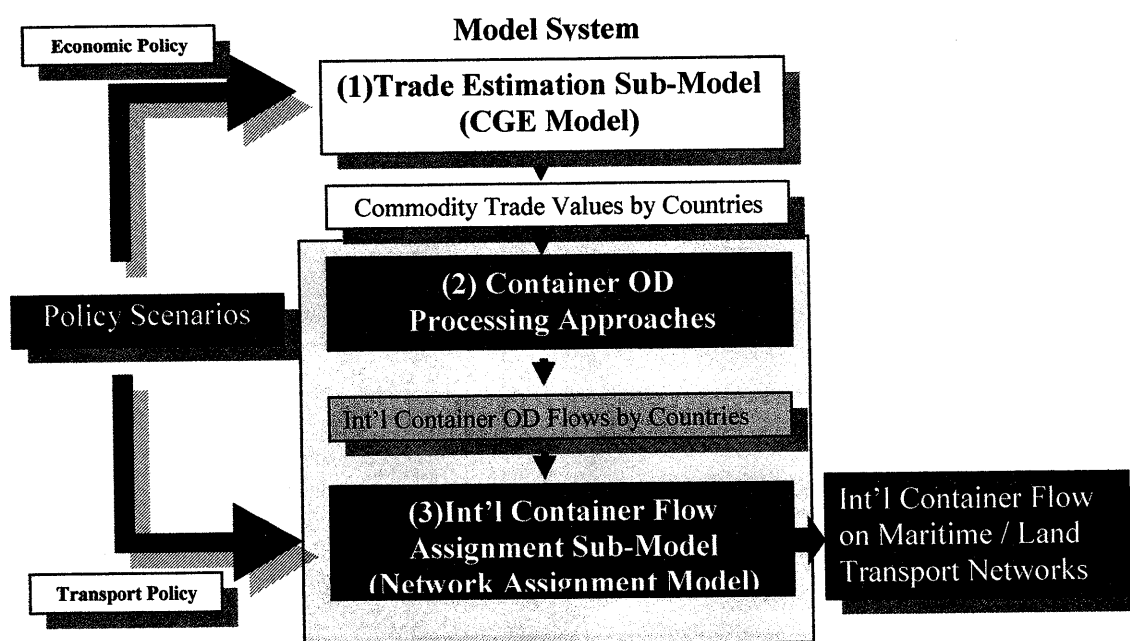


Figure 1 Model System

In this thesis, the first 2 chapters (Chapter 1 and 2) devoted to the practical background leading to this study. In Chapter 1, it discussed the importance and most concerned issues in the international container shipping transport industry from the macro aspects such as globalization to the micro aspect such as port management and shipping company fleet arrangement. In Chapter 2, it provided the literature reviews on the relative

topics mainly from such research fields: international trade modeling, container shipping transport modeling and container cargo OD estimation modeling.

In the next part of this study, from Chapter 3 to Chapter 4, an integrated trade and freight transport model is developed and calibrated. In Chapter 3, first, it identified the countries, regions, and ports which were studied in this research, totally, 32 countries and regions and their 87 representative ports were selected; second, the framework of the Trade-Freight model was described; third, the trade sub-model was stated in details; fourth, the container OD processing approaches were developed to process the monetary based trade amount OD flows (the output of the trade sub-model) into TEU based container volume OD flows (the input for the international freight transport network sub-model). Additionally, a series of approaches were also used to split the country based container OD flow into the province/prefecture based data due to the more detailed research needs. Finally, the international freight transport network sub model was formulated, which consists of shipper sub-model and carrier-model. It can simulate the interactive actions between shippers and carriers, such as shipper's choice behaviors of land route, transport modal, port and shipping company; carrier's choice behaviors of sea cruising route, transshipment port and the fleet arrangement of different size containerships. In Chapter 4, each sub model was calibrated and verified.

In the next section, this integrated trade-freight model was used to do Free Trade Agreement policy and Port policies appraisals on the international container transport industry. By these policy simulations, we can answer some recently concerned issues which are listed in the background parts. It also shows the model system can be a good tool for the policy makers.

Finally, in Chapter 6, it concluded that the developed model is the first model system that can reproduce the container cargo movement on the sea and land transport network on the global level by considering the interactive behavior between shippers and carriers; meanwhile, it also can present the transshipment among different ship size and shipping companies. It is also the first model system that can simulate the changes of the international container movements on the sea and land transport network under the various policy scenarios.