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Inland Tansport and Logistics in the ESCAP Region

-Rep. of Korea, China, and Uzbekistan Cases-

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CONTENTS

TABLE

FIGURE

SUMMARY

Containerized cargo is the most dynamic sector of global trade and 90% of the volume of international trade still moves by sea. It has been a major important element of not only maritime transportation but also world trade of entire global industrial structure. Investment in a container ship and a container terminal requires a large amount of capital. For this, governments and private sector investors should take into account the long- term investment. In order to making successful decisions for the development of shipping and port investment strategies, the United Nations Economic and Social Commission for Asia and the Pacific(UN ESCAP) secretariat has developed the computer-based Maritime Policy Planning Model(MPPM). This MPPM is basically focused on a planning context for port-to-port operations.

In recent years, intermodal transport systems and their connections to the inland cities play a crucial role in the economic development of the regions of the country. An efficient logistics network system for door-to-door services should facilitate international and bilateral trade. With respect to integrated logistics services in supply chain management, the extension of the MPPM into inland cities is thus highly desirable. In this regard, the Korea Maritime Institute(KMI) conducted the study as an international cooperation with UN ESCAP. Hence the aim of this study was to provide the basic information for extending the ITPM(Integrated Transport Planning Model) that can handle not only maritime transportation but also inland

transportation in the ESCAP region. Consequently, ITPM can support the analysis of overall transportation system of the ESCAP region, possibly linking Trans Asian Railroad and Trans Asian Highway. In this study, three countries, Republick of Korea, China, are Uzbekistan, were chosen and investigated with respect to the cargo flows. In case of China, nine provinces along the Yangtze River were considered.

Some of findings from the case studies can be summarized as the following manner. But the reliability of the data used should be taken into account since various companies and organizations provided them in terms of their own situations. It points out that this in not absolute values. Initially road transport may be cheaper than rail or river transport over shorter distance because the initial costs or time are required to move the products to the railway stations or river ports. Like Korea, road transport is dominant mode of cargo transportation since most of cargos could be delivered within about 8 hours by trucks. This indicates that the minimum distance between major transshipment points in an inland transport network might be more than 8 hour-transit time for reducing model complexity. On the other hand, a big country like the China could have a number of various routes to be explored with combination of different transport modes. As the distance increases, river transport has a lower per kilometer cost than rail. At the same manner, railway has a lower transport cost than road. It means that the MPPM has to extend the optimization modeling module embodied in the Liner Shipping Network Model.

For landlocked countries like Uzbekistan, transit transport at border crossings is one of the most constrained parts by delays and costs. These countries have traditionally developed bilateral transit agreements with neighboring nations to overcome geographical constraints. But they could be

affected by political and economic changes. In addition to costs and time factors, these countries are thus also facing the issue of reliability of the route where reliability can be explained in terms of consistent transit time, predictability of costs, damage of journey, and overall security concerns. Consequently, a module that takes into account such reliability issue could be required to analyze the intermodal network inlandlocked countries. At the same time, China as a developing country also has to consider the issue of reliability since this country does not have enough transportation infrastructures for example, rail transportation in China.

The Korea government is currently promoting projects linking the Trans-Korean Railways (TKR) to the Trans-Siberian Railway (TSR) and eventually connecting TKR to the TAR and European Railways. At the same time, China, Russia and Mongolia are actively pursuing connection of their railways to TKR. In the near future, this new corridor can make big changes into a transportation network in the Eurasia continent since transportation cost and transit time to Europe can be saved. Eventually this will serve as the land bridge promoting economic union of Asia and Europe. In this regard, UN ESCAP is pushing forward construction of the northern route of the TAR.

As a result, the ITPM for the inland transport and logistics system should integrate inland transportation infrastructure, logistics components, and data. Finally, it is hoped that the contents of the study will contribute a better understanding of transport issues for the three countries and thus assist in formulating effective policies to enhance their intermodal transport systems and processes.

Chapter 1
Introduction

1. Objective and Scope

Containerized cargo is the most dynamic sector of global trade and 90% of the volume of international trade still moves by sea. It has been a major important element of not only maritime transportation but also world trade of entire global industrial structure. Investment in a container ship and a container terminal requires a large amount of capital. For this, governments and private sector investors should take into account the long-term investment. In order to making successful decisions for the development of shipping and port investment strategies, the United Nations Economic and Social Commission for Asia and the Pacific(UN ESCAP) secretariat has developed the computer-based Maritime Policy Planning Model(MPPM)[1] Regional Shipping and Port Development Strategies, United Nations. This MPPM is basically focused on a planning context for port-to-port operations.

In recent years, intermodal transport systems and their connections to the inland cities play a crucial role in the economic development of the regions of the country. An efficient logistics network system for door-to-door services should facilitate international and bilateral trade. With respect to

1) *Regional Shipping and Port Development Strategies,* United Nations.

integrated logistics services in supply chain management, the extension of the MPPM into inland cities is thus highly desirable. In this regard, the Korea Maritime Institute(KMI) conducted the study as an international cooperation with UN ESCAP[2] Hence, the objective of this study is to provide the basic information for extending the ITPM that can handle not only maritime transportation but also inland transportation in the ESCAP region. In this study, three countries, South Korea, China, are Uzbekistan, are chosen and investigated with respect to the flows of containers. In case of China, nine provinces along the Yangtze River are considered in this study. Finally, it is hoped that the contents of the study will contribute a better understanding of transport issues for the three countries and thus assist in formulating effective policies to enhance their intermodal transport systems and processes.

2. Maritime Policy Planning Model(MPPM)

The aim of the MPPM that is an integration set of computer modules is to develop and validate computer models covering the trade, shipping and port sectors in order to assist maritime transport planners in evaluating existing and new policy alternatives. The computer models are based on fully comprehensive and consistent databases of maritime trade flows, shipping flows, port productivity and port utilization. It was developed under a project entitled the “Regional maritime strategy study” by the ESCAP secretariat with funding from Austria, Japan, the Netherlands,

2) UN ESCAP UN ESCAP signed Memorandum of Understanding (MOU) with the Korea Maritime Institute (KMI) on December 3, 2004. UN ESCAP regarded KMI as a regional Institute.

Norway, the United Kingdom of Great Britain and Northern Ireland, and he United Nations Development Programme.

It currently includes three modules which are Trade Module, Port Strategic Planning Module, and Liner Shipping Network Model(LSNM)[3]. The Trade Module is used to forecast maritime trade on a country-to-country basis. Separate forecasts are produced for each of 53 commodities and for four transport modes such as container, break bulk, dry bulk, and liquid bulk. The three main activities are the trade generation, trade distribution, and modal split phases.

The Port Strategic Planning Module links the Trade Module with the LSNM. In this module, the country-to-country trade flows by mode of transport obtained from the Trade Module are transformed to port-to-port flows. The main modes of maritime transport used in the MPPM modules are liquid bulk, dry bulk, break bulk, and container cargo. To calculate the port-to-port flows, the port share of the importing port and the port share of the exporting port are multiplied, to obtain the share in the region-to-region trade flow. This is then multiplied by the region-to-region trade flow. Port shares data were obtained from port statistics which ESCAP received from different institutions in countries in the ESCAP region and the Containerization International Yearbook. In addition, the data of the volume of cargo flows and vessel call information are to be needed as well as port infrastructure information to estimate the infrastructure required to handle the forecast ship calls.

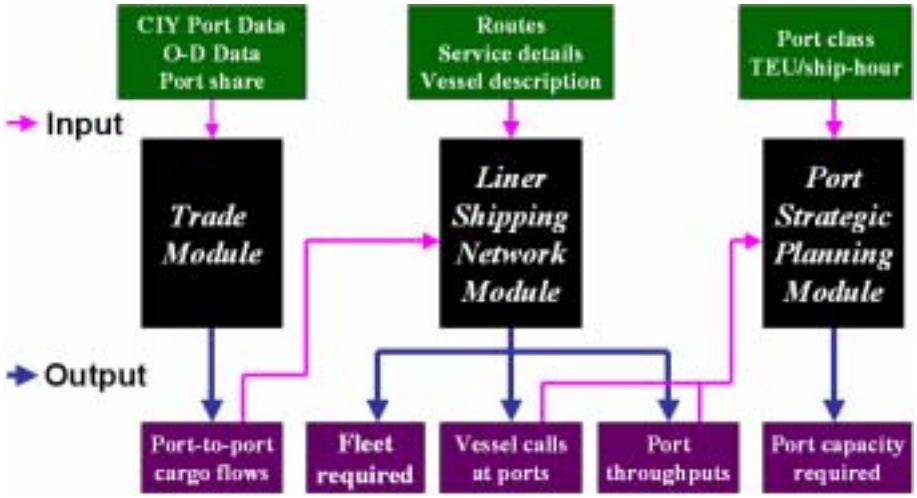
The Liner Shipping Network Model(LSNM) allocates the port-to-port containerized cargo flows derived in the Port Strategic Planning Module to

3) Manual and Computer Software for Regional Container Flows and Shipping Requirements, United Nations.

shipping routes and estimates the fleet required to carry the forecast trade and the number of vessel calls at each port in the ESCAP region. The rules governing cargo assignment are based on certain common sense axioms and assumptions and all other things being equal:

- The attractive of a service increases with frequency;
- Direct services are preferred to services requiring the transshipment of cargo;
- Services with fast transit time are generally preferred to slower services;
- Lower priced services will be preferred to higher priced services.

Figure 1. MPPM Model Structure



3. Literature Review & Study Approach

There is not much material available related to this study. Most studies have been conducted by UN ESCAP in order to develop and strengthen the

intra- and inter-regional transport on Asian continent. In this context, ESCAP initiated the integrated Asian Land Transport Infrastructure Development (ALTID) project[4]. This project included the Trans-Asian Railway and Asian Highways projects. For this, a series of studies were conducted for defining a network of road and rail linkages of sub-regional, regional, and international importance.

Due to rack of recent information, the approach to this study comprises various activities. The basic data of transportation and logistics infrastructure and facilities were obtained through books, magazines, and websites. Besides, logistics related workshops or conferences[5] available in the Korea were explored. And the costs and transit time of transporting cargos were based on tariffs that were obtained during interview with logistics and transport service providers such as carriers, forwarders, and shippers.

For more detailed information, field trips were also made, where Busan and Gwangyang in Korea, the Yangtze River in China, and Tashkent in Uzbekistan were visited. In detail, Korea, Busan and Gwangyang port authorities in Korea were visited. In case of China, port authorities of Chongqing, Wuhan, Nanjiang, Chengdu, and Shanghai were visited; a number of meeting were held with carriers, barge operators, and forwarders. In Uzbekistan, several organizations were visited, which were the Uzbek Agency for Automobile and River Transport, the State Joint Stock Railway Company, Uzbekistan airways, the State Joint Stock Company of Uzvneshtrans.

With regard to analysis, a field survey and mathematical models were

4) Transport, Communications, Tourism and Infrastruture Development Division of ESCAP developed the ALTID project implementation strategy featuring a step-by-step approach.

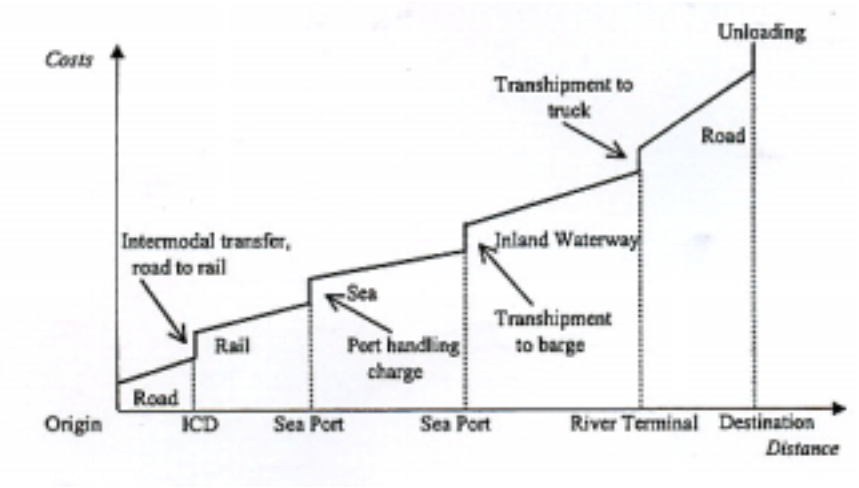
5) International Symposium on Asian Continental Railways, October 27~28, 2005, Seoul Korea.

applied. The field survey was conducted in order to get the origins and destinations of cargos in Korea. But it was impossible to get them in the other countries due to costs and time limitations. For China, the Shortest Path model was applied to identify the optimal flows of goods from Shanghai into inland cities. Finding the shortest route between sites was an important task for most shippers and carriers to transport cargos or goods so that time and money could be minimized. The Shortest Path model can be modeled using graphs with weights assigned to their edges where nodes refer to locations and edges between nodes could represent distance, time, and transportation costs etc. Then, determining the path of least length between starting point and destination point was performed.

For Uzbekistan, the cost/time model was adapted from Bersesford and Dubey[6]. The methodology included costs and time associated with transport by any mode such as road, rail, river or sea, and with transfers between modes at ports, rail freight terminals or inland depots as components. This was based on that the unit cost of transport varies between modes and this would be reflected in the cost or time curves. For example, Figure 2 showed that numerous modes of transport may be involved for goods to be moved door-to-door. At each intermodal transfer point, there will be a cost or time increase represented by a vertical step, which will be cumulated with the transport and other costs that have been incurred up to that point. When a border crossing occurs along the route, the border crossing charges or time spent can be represented by another vertical shift upward in the cost or time curve at that point, which can then be cumulated with other costs.

6) Beresford, A.K.C. and Dubey, R.C., *Handbook on the Management and Operation of Dry Ports(UNCTAD/RDP/LDC/7).*

Figure 2. Multimodal Transport from Origin to Destination



4. Report Structure and Contents

This study consists of four chapters for which three countries from ESCAP region are chosen. The major coverage of this study is as follows: Chapter 1 provides an overview of the objective of this study and a research methodology. Chapter 2 discusses an economic overview of each country and illustrates transportation and logistics infrastructure. Chapter 3 is devoted to discussion of case studies with respect to inland transportation according to characteristics of logistics infrastructure in each country. Chapter 4 examines a summary of the main findings from each case study.

Chapter 2

Intermodal Transport and Logistics Infrastruture

1. South Korea

1) Economic Overview

South Korea (Korea) lies adjacent to China and Japan. With a land size slightly larger than the state of Indiana in U.S, Korea is populated by almost 48.5 million people in 2004. The country is primarily mountainous, with approximately 80% of its population concentrated in urban areas. Korea's largest cities include Seoul, Busan, Daegu, Incheon, and Gwangju. Their populations are 10.9 million, 3.8 million, 2.2 million, 2.1 million, respectively.

Figure 3. A Map of Korea

Korea has achieved a rapid growth into the modern economy through the late 1980s, and this success was made by a system of close government-business ties. However, the Asian financial crisis of 1997-1999 exposed weaknesses in Korea's development model, including high debt-equity ratios, massive foreign borrowing, and an undisciplined financial sector. Economic growth fell into a negative 6.9% in 1998, and then strongly recovered to 9.5% in 1999[7].

Since the financial crisis, Korea has implemented structural reforms in order to aim at transforming its economy into a more transparent, less regulated and more market-driven business environment. As a result, growth in 2000 was 8.5% but fell back to 3.3% in 2001 because of the slowing global economy, falling exports, etc. In 2002, growth was an impressive 7.0% supported by consumer spending and exports. However, economic growth fell to 3.1% in 2003 because of a downturn in consumer spending. In 2004, growth was recovered to 4.6% on the behalf of rapid export drive.

Table 1. Korea Fact File

Demographics/Economics	
Area	98,480 km^2
Population	48,422,644
GDP	$925.1 billion
GDP Growth	4.60%
GDP Composition:	
Agriculture	3.2%
Industry	40.4%
Services	56.3%

Source: World Factbook, 2004

7) The Bank of Korea (http://bok.or.kr/).

Korea's major export partners in 2004 were China(22.4%), US(17.8%), Japan(8.3%), and Hong Kong(4.8%) and export commodities are semiconductors, automobiles, telecommunications equipments, computers, steel, ships, petrochemicals, and etc. On the other hand, major import partners are Japan(21.6%), US(12.7%), China(12.3%), Saudi Arabia(5.1%) and import commodities are machinery, electronics and electronic equipment, oil, steel, transport equipment, organic chemicals, plastics, etc.

Table 2. Korea' s Major Trading Partners (million)

Exports			Imports		
Rank	Total	$250,600.0	Rank	Total	$214,200.0
1	China	$56,134.4	1	Japan	$46,267.2
2	US	$44,606.8	2	US	$27,203.4
3	Japan	$20,799.8	3	China	$26,346.6
4	Hong Kong	$12,028.8	4	Saudi Arabia	$10,924.2

Source: World Factbook, 2004

2) The Modes of Transportation

Due to the fast changing domestic and international economic environment, establishment of efficient logistics system is necessary if industrial competitiveness is to be enhanced. To do this, the 20-year basic plan (2001-2020) on national logistics has been drawn up (see Table 3). In addition to the transportation infrastructure, developing an integrated logistics information system linking land, sea and air cargo information networks with clearance, trade and other related networks has been emphasized as well.

Table 3. Overview of 2001-2020 Basic Plan on National Logistics

Mode	Agenda
Road	- Making a network with 7 roads running from north to south and 9 expanding east to west, which can cover the whole country - Aiming to prepare for balanced regional development, eventual unification of the two Koreas, and its links with the continent.
Rail	- Constructing "X" shaped expressway network traversing the Korean peninsula and connecting the capital region with other major regions around the country, as well as electrifying the 5 major trunk rail lines.
Seaport	- Fostering Busan and Gwangyang Ports into northeast Asia's mega hub ports by the year 2011.
Airport	- Developing Incheon International Airport into northeast Asia's hub airport which makes it a major transit point for Asia's air passengers headed to North America and Europe. - Expanding/buildingregional airports in preparation for age of globalization and localization.

In order to execute the plan, number of ways are being sought to secure the enormous funds necessary for the aforementioned infrastructure expansions. These include active promotion of private investment projects, increasing special fuel tax, and gradually raising toll, and other facility usage fees to practical levels.

(1) Sea Transportation

By 2010, 4.2 million TEU out of 19.2 million TEU are expected to be handled as T/S cargoes, creating about $840 million in profit for T/S cargoes alone[8]. By knowing that the new mega ships will be developed and large carriers will limit vessel calls to major hub ports, Korea has a plan to make

8) The Ministry of Maritime and Affairs & Fisheries (http://www.momaf.go.kr/)

the Korean Peninsula a strategic gateway to the world with the development of the Ports of Busan and Gwangyang as two hub ports. To promote the two ports as comprehensive logistics centers, establishment of special economic zones in the distriparks, the construction of logistics complexes, and the expansion of port service functions have been developing.

In Korea, the government's role in the shipping industry has been reduced step by step through the policy of liberalization and openness since the late 1980s. Continued deregulation has been carried out so that the global shipping companies may compete fairly in the Korean market. For this, the international ship registration system was introduced in 1998, and the ship investment company system of 2002 was also introduced to solve problems related to ship financing. And the tonnage based ship taxation system that currently operated by the UK, the Netherlands, Norway and Germany is expected to be enforced since 2005. With such upgraded marine institutions and systems, shipping companies in Korea will be guaranteed free business activities in the fair market order. The Ministry of Maritime and Affairs & Fisheries also has set up new visions and measures to supplying quality seamen by the policy shift from the traditional training system to the development of a stable and efficient crew management system. The mid and long term plan for the development of seamen that is a new policy initiative to improve the training system, advance welfare of ship crew, and protect their rights is designed to make the work a more attractive job choice.

Korea seeks to play the role as the main logistics hub of the Northeast Asian economy, and take the initiative in the region's economic evolution. For this, the Ministry plans to transform Korea's major ports from simple transit centers to high value-added international logistics centers, and further

promote those ports as intermediary junctions between the continent and the sea. The first step in realizing this vision is expanding the facilities at the Port of Busan and the Port of Gwangyang, and building distriparks nearby. In an effort to facilitate activities of the global logistics enterprises that invest in the distriparks of the two ports, the Korean has designated the two ports and their distriparks as Free Trade Zones, with various tax, duty and rent benefits. It will also create international logistics consulting centers and various supporting facilities to maximize conveniences for companies setting up operations in the zones.

(2) Air Transportation

a. Airlines

The most noticeable growth that Korea's civil aviation achieved since the privatization of the Korea Air Lines in 1969 is its growth into the world's fifth largest international aviation country. There are two major airlines such as Koran Airlines and Asiana Airlines. These two airlines providing 696 services a week transport about 11 million passengers domestically and internationally on 129 routes to 84 cities in 30 countries around the world every year[9].

Korea has signed 78 air agreements so far and plans to add more countries to the list in an effort to establish a worldwide network of routes for its national carriers. Further, the Ministry plans to amend agreements that are already in effect in order to upgrade the establishment of the network. At the same time, the Ministry will be implementing policies such as working to increase the number of foreign airline services to Korea so

9) The Ministry of Construction & Transportation (http://www.moct.go.kr/).

that Incheon International Airport can live up to its name as the true hub airport for the northeast Asian region.

b. Incheon Airports

With China and Japan to the left and right and Siberia and southeast Asia to the north and south, Incheon International Airport is situated at the center and has the best possible conditions to serve as the northeast Asia's transit airport for both people and goods due to the fact that it is located at the front line of Siberian air route which connects air routes in the north Pacific and northeast Asia with routes to Europe.

The passenger terminal is 6 stories high(4 above ground and 2 underground) giving a total floor area of 486,000㎡ with 44 departure gates. The departure area on the third floor will be equipped with 252 check-in counters with capacity to process 6,400 passengers per hour. The airport is also installed with 2 runways that are extra wide and extra long for take-offs and landings of next generation type aircraft. Navigational safety facility enables safe take-offs/landings with a visibility of only 200m, automatic cargo processing that can take care of cargo in under 10 minutes. And comprehensive information & communication system is capable of integrated management and operation of the whole airport. Incheon International Airport is operated for 24 hours a day providing all kinds of convenience facilities including business, leisure & recreation, commercial, residential, and logistics.

The new airport can be accesses from Seoul in just 50 minutes on the new IIA Expressway (40.2 km) which is being built as a private investment project. Once on the IIA Expressway, the airport can be reached within 30 minutes. Major facilities at the airport were completed by June 2000.

Table 4. Major Facilities of Incheon Airport

		Phase 1(1992-2000)	Final
Airport	Site area	1,150,200 m^2	4,649 m^2
	Runways	2 rundways (3,750 x 60 m)	4 runways (3,750 x 4,200 m x60 m)
	Passenger Terminal	496,000 m^2	875,000 m^2
Support Complex		2,138,400 m^2	855,360 m^2
Transportation	Expressway	6-8 lanes, 40.2 km	-
	Railway	Multi-track 61.5 km	To be completed in 2007
Capacities	Passengers(annual)	27 milllion	100 million
	Cargo(annual)	1,700,000	7,000,000

Source: Ministry of Construction & Transportation

Korea has been divided into 7 zones for airport facilities expansion project which is being implemented in preparation for the increase in both the domestic and international air transport demand (see Table 5).

Table 5. Airport in Seven Zones

	Airports
Capital Region:	- Incheon international airport
Central region	- Cheongju International Airport
Youngdong region:	- Yangyang International Airport
Kyongbuk region	- Daegu International Airport - Uljin-kun (2000 - 2003) - Yechon Airport Pohang
Busan region	- Kimhae Airport
Honam region	- Muan International Airport - Jeonju Airport
Jeju region	- Jeju International Airport

Source: Ministry of Construction & Transportation

(3) Rail Transportation

Korea has 67 railroad routes running 3,140km in 2003, and they still act as the main mode of transport for 6.3% of large cargo in Korea[10]. Beginning 1980, railroad construction has been focused more at double/ multi-tracking or upgrading the existing lines that have reached their capacities rather than building new lines. However, new railroad line are being built to connect science parks with ports to lend support to their industrial activities.

Table 6. An Overview of Rail Transportation (2003)

Daily operation frequency	Passengers: 2,715 times Cargo: 449 times Total: 3,164 times
Transport volume	Passengers: 1 billion Cargo: 93,914,546 kg
Track length	7,529,845 km (commercial distance 3,140 km) Multi-track 964.8 km (32.3%) Electrified track 675.2 km (21.7%)
Signal facilities	ATS 3,123 km (100%) CTC 1,004.1 km (32%) ABS 1,666.3 km (53%)
Trains	3,038 engine cars; 1,717 passenger cars; 14,450 freight cars, 18 miscellaneous cars; 19,223 in total

Source: Ministry of Construction & Transportation

Rail transport industry reform has been undertaken to enhance competitiveness of the industry and to provide better quality services. The reform will drive the currently government owned and operated rail transport organization into separate construction and operation organization.

10) http://www.moct.go.kr.

Figure 4. Korea' s Railway Map

In the spirit of the Joint South/North Declaration made on June 15, 2000, the two sides announced that they agreed to link the severed Kyungoui railway line at the Ministerial Meetings on July 31. And then this historical project was held on September 18, 2000(see Table 7). Connection of the severed railway between the South and North will give birth to Trans-Korean Railway(TKR) which then can be linked with the Trans-Siberian Railway(TSR) providing linkage to Asia and to Europe and

with Trans-China Railway (TCR) opening the path via land to European and Northeast Asian markets. In this way, the TKR will take place in the world as its biggest route of transport.

Table 7. Project Outline for Connecting South-North

	Railways	Road
Project description	Restoration of single track spanning 12 km between Moonsan to the disconnected point	Construction of 4-lane road of 6 km in length running parallel to the railway line (enough site available for 8 lanes)
Project cost	54.7 million won	100 million won
Implementing authority(Ministry of Construction & Transportation)	Korean National Railroad	Seoul National Territory Management Office
	The military will be responsible for removal of mines in the military-occupied and demilitarized zones as well as bedding of the roads.	

Source: Ministry of Construction & Transportation

(4) Road Transportation

In Korea, the roads have been the most important infrastructure carrying over 90% of the country's transport volume. Road expansions began along with the economic development following the 1960s and have played the leading role in the country's economic growth and territorial development. The total length of roads is 87,534 km as of 1999 (see Table 8). Since the opening of the first expressway connecting Seoul and Incheon in 1968, the expressways have been continually expanded to today's 21 routes spanning 2,040 km throughout the country.

National roads along with the expressways form the country's trunk road network providing connection between major cities, ports, airports, industrial complexes, and transport demanding regions. There are 49 national roads spanning total of 12,417 km in all directions as of December 1999. Seven expressways running vertically and 9 running horizontally measuring 6,160 km will be built by the year 2020 to form a truck expressway network. This will create a half-day life cycle zone while enhancing the functionality of truck roads at the same time. In addition to such road expansions, addition of over/under passes and bottlenecks will be dealt with, while intelligent transport systems (ITS) will be used to maximize operational efficiency by making operation and management of roads more scientific and intelligent. Further, to create safer and more pleasant road environment, all old bridges will be fully replaced, accident-prone spots will be repaired, and environment-friendly road construction practices will be actively adopted.

Table 8. Road Situation in Korea (2003)

Road Type	Responsible Authority	Length	Paving Rate	Remarks
Expressways	MOCT	2,778 km	100.0%	Authority relegated to Korea Highway Corporation
National Highways	MOCT	14,234 km	96.9%	Mayor of concerned city(shi)
Metropolitan Roads Local Roads	Mayor Governor	17,130 km 17,485 km	99.6% 77.8%	Mayor
Shi/Kun/Ku Roads	Local govt.	45,625 km	60.0%	Head of local government
Total		97,252 km	76.7%	

Source: Ministry of Construction & Transportation(MOCT)

3) Inland Logistics Facilities

(1) Inland Container Depot

Large-scale integrated cargo terminals and inland container depots are being in the capital region, Busan region, Honam region, Central region, and Youngnam region for reduced logistics cost via improved cargo distribution system. These projects are being implemented in the forms of Built-Own-Operate(BOO) or Built-Own-Transfer(BOT) as private investment projects with supports from the government which include construction of roads, railroads, water pipes, and major facilities as well as loans for land purchasing and/or project costs.

Table 9. An Summary of Project Status

Project		Location	Size	Period	Type
Capital Region	Kunpo Integrated Cargo Terminal	Kunpo, Kyunggi-do	35,640 m^2	1992-1998 (in operation)	BOT
	Euiwang ICD	Euiwang, Kyunggi-do	74,520 m^2	1992-1996 (in operation)	BOT
Pusan Region	Yangsan Integrated Cargo Terminal	Yangsan, Kyungsanam-do	32,400 m^2	1992-2000 (in operation)	BOT
	Yangsan ICD	Yangsan, Kyungsanam-do	93960 m^2	1992-2000 (in operation)	BOT
Honam Region Integrated Cargo Terminal ICD		Jangsung, Chollanam-do	103,680 m^2	1998-2010	BOO
Central Region Integrated Cargo Terminal and ICD		Cheongwon/ Yeonki, Chungchungbuk-do	68,040 m^2	2000-2010	BOO
Youngnam Region Cargo Terminal and ICD		Undecided	n/a	2001-2010	BOO

Source: Ministry of Construction & Transportation

(2) IT System for Sea Transportation

The information system for port management and container management is now being implemented at major ports in Korea. And a more upgraded information system which will oversee the logistical flow as a whole is being intensively developed. The development of the one-stop logistics service system will sufficiently reflect the positions of users including shippers, shipowners and logistics companies.

In an effort to build a comprehensive user-oriented logistics information system, the Ministry of Maritime Affairs & Fisheries is actively implementing the plan to build the "Shipping & Port Internet Data Center (SP-IDC)" within three years from 2003. The purpose of the center is to build a comprehensive logistics information system for the marine and port sector, which is based on an internet network to guarantee easy access and links with the government network Port-MIS (the Port-Management Information System), the logistics EDI network, the information system for the customs free area, and the VAN(the Value Added Network) of the private sectors.

Once built, the system will enable logistics-related personnel to go online from anywhere to file complaints or get administrative support, thereby enhancing logistics productivity in a cost-effective manner. It will further facilitate the standardization, concentration and openness of logistics in the shipping/port sectors, and will contribute significantly to the national competitiveness of the port industry.

2. China

1) Economic Overview

China, the third largest country in the world, is located in eastern Asia, which occupies one-fifteenth of the world's landmass. China's population is densest in coastal areas and becomes sparse the further west. In 1997, Hong Kong and Macao were included in China, which became Special Administrative Regions after a handover power from the British and Portuguese authorities. Chinese industry has seen spectacular growth over the last few years as a result of on going liberalization of the market into the global economy. The entrance into the World Trade Organization has helped China to raise living standards and income.

Figure 5. A Map of China

Currently, the Chinese government has actively encouraged foreign investment over the last twenty-five years. At the same time authorities hoped that they would be able to control the development of foreign companies by establishing specific regions in which they could operate. Since then the range and type of these economic zones has grown as authorities have gradually liberalized the market environment. Since 1980 a number of 'special economic zones(SEZ)' have been created in Shenzhen, Zhuhai and Shantou in Guangdong Province and Xiamen in Fujian Province. The whole of Hainan province was also designated a special economic zone.

Table 10. China Fact File

Demographics/Economics	
Area	9,596,960 ㎢
Population	1,306,313,812
GDP	$7.262 trillion
GDP Growth	9.10%
GDP Composition:	
Agriculture	13.8%
Industry&Construction	52.9%
Services	33.3%

Source: World Factbook, 2004

In 1984, China opened a further 14 coastal cities to overseas investment: Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Nantong, Shanghai, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang and Beihai[11]. Since 1988, China has expanded the areas open to foreign investment to include zones of the Yangtze River Delta, Pearl River Delta, Xiamen-

11) The Ministry of Commerce of the People's Republic of China(http://www.mofcom.gov.cn/).

Zhangzhou-Quanzhou Triangle in south Fujian, Shandong Peninsula, Liaodong Peninsula (Liaoning Province), Hebei and Guangxi. In addition, 15 free trade zones, 32 state-level economic and technological development zones, and 53 new- and high-tech industrial development zones have been established in large and medium-sized cities.

The main attractions for investing within these zones are the advantageous tax and infrastructure environments. Shanghai has some of the best known SEZs such as Waigaoqiao Free Trade Zone (FTZ) and Zhangjiang Hi-tech Industrial Development Zone (HIDZ). In the Yangtze River delta this has meant greater focus on Shanghai's neighboring provinces of Jiangsu, Zhejiang and Anhui. The cost advantages of investing outside of SEZs are evident in the Yangtze River Delta. Labour costs can be up to 20% lower, due partly to lower overall salaries as well as fewer labour regulations and social benefits. In many cases new industrial parks have been set up without government approval as local authorities compete for FDI. Although they cannot offer tax incentives, they can subsidise new companies, and land prices are usually much lower. For instance Xishan Municipal Development Zone with a land price of 7.25 USD/m^2 is more than sixteen times cheaper than Waigaoqiao FTZ.

Table 11. China's Major Trading Partners(million)

Exports			Imports		
Rank	Total	$583,100.0	Rank	Total	$552,400.0
1	US	$132,946.8	1	Japan	$88,936.4
2	Hong Kong	$94,462.2	2	Taiwan	$60,211.6
3	Japan	$72,304.4	3	South Korea	$57,449.6
4	South Korea	$25,656.4	4	US	$425,348.0
5	Germany	$23,324.0	5	Hong Kong	$408,776.0

Source: World Factbook, 2004

2) The Modes of Transportation

(1) Sea Transportation

a. Shipping

There are key China-owned shipping lines serving ocean shipping solutions are COSCO, China Shipping, Evergreen(Taiwan), and OOCL. The COSCO group was founded in 1961 and has grown into a $17 billion corporation, which is the most recognized global brand in shipping[12]. The group with its network of subsidiaries and associate companies provides services in freight forwarding, ship repairing, terminal operators, container manufacturing, trade, financing, real states, IT, and etc. China Shipping Group was founded in 1997 in Shanghai. It is one of the key state-owned enterprise under the direct administration of the Central Government. This group has specialized shipping fleets of oil, tankers, tramps, passenger, ships, container vessels and specialized cargo ships.

Among foreign shipping lines, APL, Maersk Sealand, NYK, OOCL and P&O Nedlloyd were the first companies to be awarded wholly-owned status in the country in a bid by the authorities to introduce new capital to the market. These companies were allowed to establish forwarding and logistics subsidiaries without joint ventures with local companies thus giving them a major advantage over competition.

Trade with China is now estimated to account for 25-30% of all container traffic, with the proportion being higher on key routes with North America and Europe. This is even higher if trade with Hong Kong is taken into account. Within the region some of the busiest routes are between China and Japan.

12) COSCO Group (http://www.cosco.com.cn/).

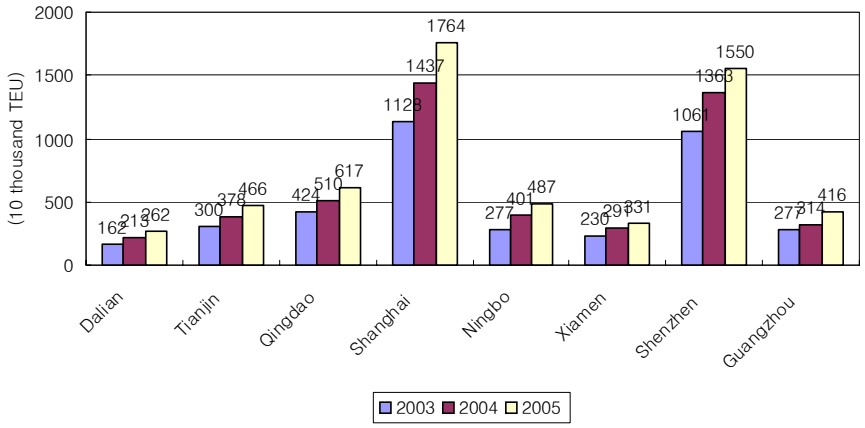
b. Seaports

Port facilities have improved rapidly in recent years. China’s 14,500 km coastline contains 200 seaports, which handled 1.7 billion tones of goods in 2002. Most ports are relatively shallow and this prevents modern container ships from using many of them. However, Yangshan port has been developing in Shanghai over the next 20 years at an estimated cost of 14.3bn Yuan. The first five berths are expected to be completed by 2005 and will boost the port’s capacity by 2 million TEUs a year. The port will be linked by a 32km bridge linking with the mainland.

China’s best existing deepwater port is at Ningbo in Zhejiang province. Other majorports include those at Fujian as well as Guangzhou and Shenzhen. In 2003, China's largest Shanghai port ranked third worldwide in cargo-handling quantities, behind Hong Kong and Singapore. With the Yangshan Deep-Water port in Shanghai, the Shanghai regionwill have approximately 10km of deep-water shoreline and 50 deep-water berths. At present, the Shenzhen Port, located in south China's Guangdong Province with water more than 13 meters deep, is the second largest port on China's mainland and ranks fourth worldwide. The northern Tianjin port is also developing quickly. The 144-year-old northern port handled 160 million tons of cargo last year and currently is the largest port in north China.

According to statistics from the Ministry of Communications (MOC), the number of containers handled annually by Chinese ports leapt from 15.59 million in 1999 to 48 million in 2003. China dealt with approximately one quarter of the containers in global transport last year. Figure 6 shows the trend of container throughputs of major ports in China.

Figure 6. The Trend of Container Throughputs of Major Ports



(2) Air Transportation

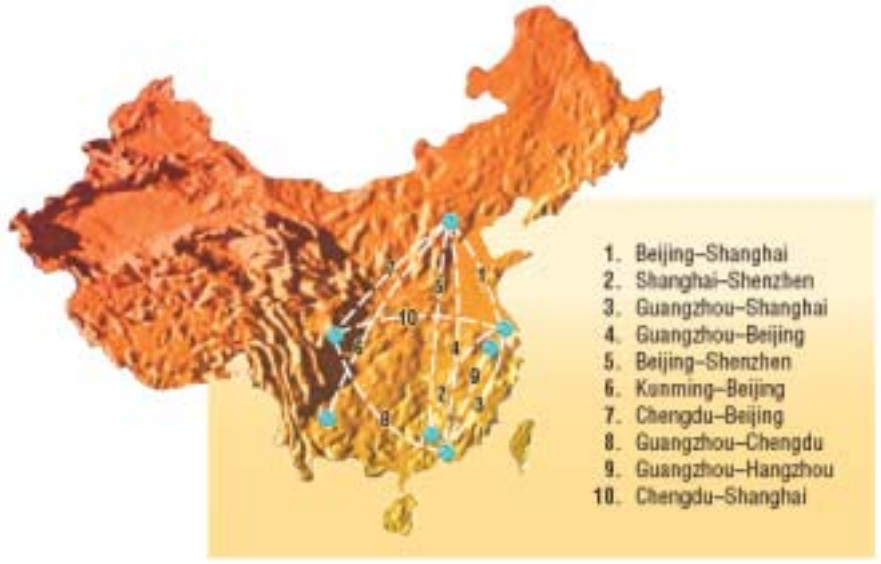
a. Airlines

One of the characteristics of the Chinese air freight industry is the large domestic market which is the second biggest domestic market in the world. According to Boeing the market has grown at an average annual rate of more than 20% per year since 1991. In terms of weight the domestic Chinese air cargo traffic currently accounts for 4.6% of the world's total air cargo traffic although in terms of tonne kilometers this proportion is just 1.3%. The advent of a higher value manufacturing base has stimulated the growth of the industry. International air freight has also grown, driven by strong air export traffic to Asia, Europe, and North America.

Most of China's air cargo industry activity is located between Yangtze River Delta and Pearl River Delta and approximately 44% of all domestic air cargo tonnage can be found in the top 10 city pairs, with the top 8 lying in a triangular corridor consisting of the cities of Beijing, Shanghai/

Hangzhou, and Guangzhou/Shenzhen[13] .

Figure 7. Top City Pairs for Domestic Air Cargo Traffic



Hong Kong is exceptionally important to China's air cargo industry. Its international links mean that a large proportion of goods exported from south China are routed through Hong Kong. Its position has been strengthened by a recent agreement with mainland China as Chinese airlines will be allowed to expand their services to foreign cities via Hong Kong. Hong Kong airlines have also been awarded greater access to the mainland.

China and the US reached a new civil aviation agreement in June 2004. The deal allows five new carriers from each side access to the US-mainland markets and will see weekly flights increase from 54 to 249 by 2010. Hong Kong also benefits as more traffic between the US and China will have

13) World Air Cargo Forecast 2004/2005, Boeing.

positive spillover effect on the traffic demand from the Sino-Us agreement in the Asian region.

b. Airports

From 1996 to 2000, China invested $7.9 billion in airport construction, focused around Shanghai, Beijing and Guangzhou. Dozens of new airports as well as renovations have been completed, including showcase projects in Beijing and Shanghai. There are now 145 civil airports in China, with a further 100 airports planned by 2010. Construction of 28 airports is in work, and the remaining 72 are set for construction between 2005 and 2010[14].

More than 27 airports in China's western regions are planned in accordance with China's 5-year plan and the government's "Go West" development plan. The government has recently increased investment in the energy, mining, education, and transportation sectors of the western provinces(e.g., Xinjiang, Yunnan). In addition, foreign investment in the western provinces is encouraged through certain guarantees for overseas investors considering projects in China's western regions. Increasing investment by the government and incentive programs to attract foreign investors to the west will ultimately drive geographic expansion of the domestic China air cargo network. Growth in economic activity in the western cities, which currently lags that in the eastern cities of Beijing, Shanghai, and Guangzhou, will ultimately contribute to growth in air traffic for the region as a whole.

14) The General Administration of Civil Aviation of China.

(3) Rail Transportation

China's railway network with 75,000km is the third-longest in the world with only USA (230,000km) and Russia (85,800km) longer. In terms of rail freight output China is the second largest market in the world, accounting for 1,424,980 million tonne-kms[15]. The Chinese government has prioritized investment in rail infrastructure in order to make rail more responsive to market needs. This includes speeding up railway construction in western China and adding capacity in the main corridors of the eastern network.

One of the most important goals is to strengthen the five main arteries serving north-south, south-west, north-east, and north-west corridors. This will mean in the long term constructing four north-south lines: Nan-Kun new line, Xi-Kang new line, Harbin-Dalian Line electrification, and Qin-Shen passenger by-pass, and four east-west lines: Shuo-Huang new line, Han-Ji new line, Hou-Yue and Zhu-Liu lines double-tracking and electrification.

Recent railway projects include the laying of a second track along the Beijing-Kowloon (Hong Kong) line, the single track of which was originally completed in 1996. A RMB 6 billion ($720 million) railway line to Kashgar in Southern Xinjiang was completed in 2001. And a railway line linking Tibet to the national network is also being constructed at a cost of US$3.3 billion and its construction is to be completed in 2007. An additional RMB 350 billion ($42 billion) is being spent on the laying of 6,000 km of new lines as well as 3,000 km of double tracks where single tracks already exist.

A further project is underway to improve the Zhe-Gan line and raise the maximum speed from 120 km/h to 200 km/h. This will include improved

15) The Ministry of Railways.

signaling and communications, and electrification. There are also on-going projects to modernize track on some of the most heavily used portions of the network. By 2010, the Chinese authorities plan to have expanded the network to 90,000 km, 40% of which will be double-tracked and 40% electrified.

Figure 8. The Map of China' s Railroad Network

(4) Road Transportation

China has built a road network linking its provinces. During 1996 to 2000, 216,900 km of roads were built, expanding the nation's total road network by 18% to 1.4 million km. This expansion came close to matching a 20% increase in traffic over the same period. By 2002, China had around

25,000 km of roads. A further 200,000 km of roads are planned which will connect 93% of the villages across the country. However, the road network is likely to remain inadequate for the demands for transport in China. In 2000, road freight in China totalled 613,000 million tonne-km.

China's first motorway was constructed in 1988 stretching 18.5km from Shanghai to Jiading. Since 1996 about two thirds of government expenditure on infrastructural projects has been invested in the road network. The programme is scheduled to last until 2015 when in total the network should have grown to approximately 35,000 km of toll motorway. Presently China is investing about RMB 200bn ($24bn) on highway construction. This is being funded partly from the government and from provincial sources. However private sector participation is being increasingly sought, as is funding from the World Bank and Asian Development Bank. China's Ministry of Communications states that more than $1bn a year has been gathered from these sources every year since 1994.

The development of western China is high on the list of priorities and considerable resources have been invested in the region. The lack of capacity on a series of major inter-provincial trade corridors is judged to be one of the reasons why the benefits of rapid economic growth have not been evenly distributed. By 2006 it is planned that the motorway network in the region will increase to 15,000 km from 2,700km in 2000.

Figure 9. The Map of China' s Road Network

3) Inland Logistics Facilities

(1) Warehousing and Logistics Parks

Up to this moment, Chinese warehousing has generally been of a very poor standard, with inadequate IT systems and poor connecting transport infrastructure. This has led to high discrepancy rates, damaged goods and very little visibility of stock. This had resulted in manufacturers building their own warehousing. However, recently the Chinese government has taken a more pro-active role. The huge demand for warehousing and

distribution has led to the development of a large number of officially sanctioned and encouraged logistics parks across China.

However the large-scale construction could result in an over supply according to some analysts. According to the National Bureau of Statistics, about 6% of China's logistics parks were empty in 2003, a figure which is continuing to rise. Another of the major problems is the lack of skilled logistics professionals able to work in distribution facilities. Chinese government will govern market admission, land, taxation, financing, standardization, investment and Sino-foreign co-operation policies related to the logistics park development.

3. Uzbekistan

1) Economic Overview

Russia conquered Uzbekistan in the late 19th century. Stiff resistance to the Red Army after World War I was eventually suppressed and a socialist republic set up in 1924. During the Soviet era, intensive production of cotton and grain led to overuse of agrochemicals and the depletion of water supplies, which have left the land poisoned and the Aral Sea and certain rivers half dry. Independent since 1991, the country seeks to gradually lessen its dependence on agriculture while developing its mineral and petroleum reserves. Current concerns include terrorism by Islamic militants, economic stagnation, and the curtailment of human rights and democratization.

Table 12. Uzbekistan Fact File

Demographics/Economics	
Area	447,400 km^2
Population	26,851,195
GDP	$47.59 billion
GDP Growth	4.40%
GDP Composition:	
Agriculture	38.0%
Industry	26.3%
Services	35.7%

Source: World Factbook, 2004

Uzbekistan is a dry country of which 11% consists of intensely cultivated irrigated river valleys. More than 60% of its population lives in densely populated rural communities. This country is now the world's second-largest cotton exporter and a producer of gold, oil, chemicals, and machinery. Its biggest exporting partner is Russian Federation, Tajikistan and Italy, and major export commodities in 1998 were cotton(41.5%), gold(9.6%), and energy products(9.6%). It major importing partners are Russian Federation, Republic of Korea, and Germany, and its major import commodities are machinery/equipment(49.8%), foodstuffs(16.4%), and chemicals(19.9%). Its graphical description of Uzbekistan is shown in Figure 10.

Table 13. Uzbekistan' s Major Trading Partners (million)

Exports			Imports		
Rank	Total	$3,700.0	Rank	Total	$2,820.0
1	Russia	$784.4	1	Russia	$744.5
2	China	$518.0	2	South Korea	$304.6
3	Ukraine	$259.0	3	Germany	$265.1
4	Turkey	$233.1	4	China	$234.1
5	Tajikistan	$214.6	5	Kazakhstan	$169.2
6	Bangladesh	$155.4	6	Turkey	$126.9

Source: World Factbook, 2004

Following independence in December 1991, the government sought to prop up its Soviet-style command economy with subsidies and tight controls on production and prices. Uzbekistan responded to the negative external conditions generated by the Asian and Russian financial crises by emphasizing import substitute industrialization and by tightening export and currency controls within its already largely closed economy. The government, while aware of the need to improve the investment climate, sponsors measures that often increase, not decrease, the government's control over business decisions. A sharp increase in the inequality of income distribution has hurt the lower ranks of society since independence. In 2003, the government accepted the obligations of Article VIII under the International Monetary Fund(IMF), providing for full currency convertibility. However, strict currency controls and tightening of borders have lessened the effects of convertibility and have also led to some shortages that have further stifled economic activity.

Figure 10. A Map of Uzbekistan

2) The Modes of Transportation

Since Uzbekistan is a landlocked country, railways, airlines, and roads could be the only transport modes. In particular, road transport is in poor condition and there are few trucks. Thus, railways have played a major role in transportation, carrying almost 90% of all surface freight. Uzbekistan is enclosed by Kazakhstan, Turkmenistan, Kyrgyzstan, Tajikistan, and Afganistan. In 1991, the existing east-west lines of national railways in those countries were lined to tracks of the railways of the China after the collapse of the Soviet Union. In 1992, a direct line linking Lanzhou, China to Tashkent, the capital of Uzbekistan via Almaty, begun operations.

(1) Air Transportation

a. Airline

Uzbekistan Airways National Air Company(UA) was founded on 28 January 1992 by the Decree of the President of the Republic of Uzbekista n.[16] Soon after its establishment a national program for the development of civil aviation in independent Uzbekistan was launched including the complete reconstruction of new air terminal complexes, re-equipping airports in accordance with ICAO requirements and establishing a base for training professional staff. The country's air code was accepted and soon the modernization of the entire air traffic control system started with the aim of meeting international standards.

UA entering the world market of international aviation aimed at increasing its international destinations by establishing regular flights to

16) Interview data provided by "O'zbekiston havo yo'llari" National Airways Company.

more than 20 international destinations. Tashkent has direct links practically with many major European cities, the US, Japan, as well as Southeast Asian countries. All international routes use western-produced liners including Boeing-767/757's, A-310's, and RJ-85's. The air fleet of UA is being completely renewed in order to meet ICAO requirements especially in the area of ecology. The fleet of UA lines includes five Boeing-757 and 767's.

b. Airports

Currently, there are twelve airports in Uzbekistan, where the main air gate to this country is Tashkent Airport located in the capital. Liners from large international airlines land at Tashkent Airport on transit flights. Tashkent Airport has two new runways which were reconstructed completely for 1995-1996 and a modern lighting system was installed. In addition, the international airports of Samarkand, Bukhara and Urgench serve both passengers and liners according to international standards. The Termez Airport is presently being reconstructed. The Airport Samarkand is a gate to the world-known monuments of the ancient civilization. Any model of liners of any air companies of the world could be accepted at the airport Samarkand thanks to the complex reconstruction of the runway, air navigation system, and installation of a new lighting equipment.

The Airport Bukhara is an open gate to one of the ancient Eastern cities. The airport Bukhara looks as modern as that ones in Samarkand and Urgench cities. The Airport Urgench is known as a new generation airport. According to the plan of reconstruction with the assistance of the forces of Leng Alarko Marubeni in a short possible time new objects were constructed including runway corresponding to the 1st category of ICAO, the Air Traffic Control Center, passenger terminal and a modern lighting

equipment. Also, the Airport Termez gains new face and has a status of international airport. Termez is an ancient city of Uzbekistan.

(2) Rail Transportation

a. The East-West Line

The east-west line from China crossing into Kazkhstan links up with the most easterly of four north-south lines at Aktogay, which leads southwest to Almaty. From Almaty, about 1000km west, the east-west line crosses into Uzbekistan and enters Tashkent. From Tashkent, the line continues westwards for about 350 km to Samarkand, and to Asgabat, which is around 1000 km west, the capital city of Turkmenistan. But before reaching Asgabat, a southerly line branches off at Tedzhen heading for the town of Sarakhs at the border with Islamic Republic of Iran. A 300 km line was constructed from Sarakhs to Maxhhad, the terminus for the Iranian railways line from Tehran. It opened in 1996[17]. The line south from Tehran goes via Sirjan to Bandar Abbas on the Persian Gulf giving maritime access to the landlocked countries of Central Asia.

b. The Four North-South Lines

The four main lines of Central Asia have a general north-south orientation. Two connect with the Trans Siberian Railroad in the north, and the other two converge on Moscow. The easternmost of these lines is about 1700km long and runs from Almaty north past Aktogay to Novorsibirsk on the Trans Siberian. The nest line to the west connects with the Trans Siberian at Omsk and Yekaterinburg, via Petropavlovsk. From Petropavlovsk

17) Interview data provided by “O‘zbekiston Temir yo’llari” State Railway Joint Stock Company.

the line runs south through Astana, the new capital of Kazakhstan, and then connects with the east-west line at Chu. Almaty lies to the east of Chu on east-west line. The third and forth lines begin in Moscow and its suburban and run southeast. One line passes east of the Aral Sea, while the other passes its west. They connect with the east-west line at Ary's and Chardzhou, respectively.

Figure 11. The Trans-Asian Railway Routes

(3) Road Transportation

Transport Corridor Europe-Caucasus-Asia (TRACECA)

The European Union initiated the TRACECA program in 1993, as the road to be a supplement to all the traditional routes[18]. It is aimed at the

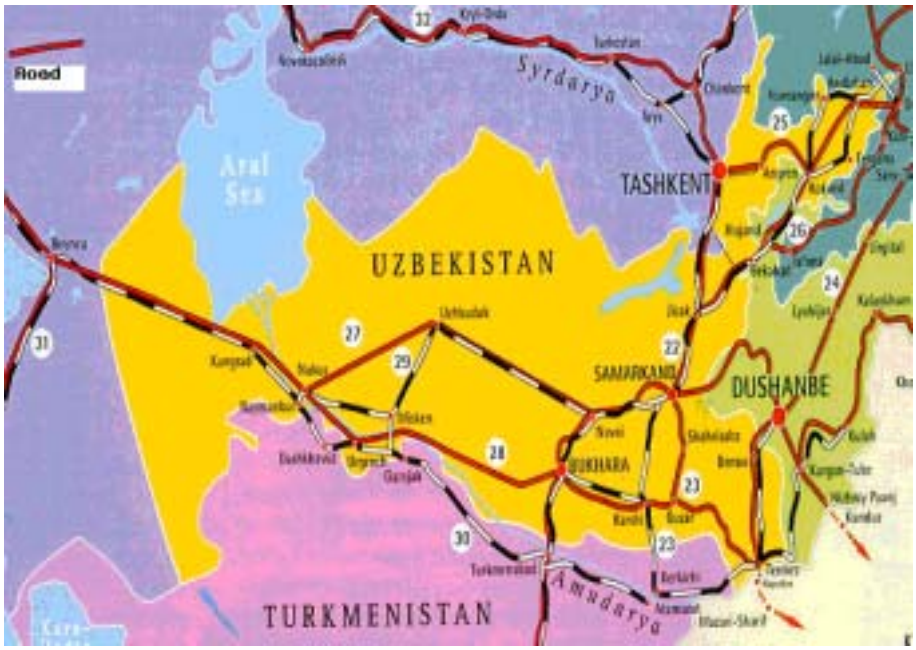
18) Interview data provided by Uzbek Automobile and River Transport Agency.

development of the transport corridor beginning in Europe passing through the Southern Caucasus, the Black and Caspian seas and going into Central Asia. In its essence the route repeats one of the lines of the Great Silk Road. 12countries including Uzbekistan such as Armenia, Azerbaijan, Bulgaria, Georgia, Kazakhstan, Kyrgyz, Moldova, Mongolia, Romania, Turkey, and Ukraine signed the multilateral agreement on international transport in the development of the transport corridor Europe-the Caucasus-Central Asia in 1998 in Baku, the capital of Azerbaijan. All in all 53 projects worth 110million Euros were financed within the framework of the TRACECA program for the period of 1993-2002. About 60% of the budget of TRACECA was used for realization of investment projects, promoting creation of the favorable investment climate in the region.

Thus, shipment of goods to Europe via TRACECA Transport Corridor(East-West) is much more attractive in comparison with other alternative routes. For example, the distance along the main transoceanic route from Iokogama to the largest West-European ports such as Rotterdam, Hamburg, Antwerp, and others is more than twice longer than that of the TRACCA routes. Today, thanks to the implementation of the European Union TRACECA program, the member-states have extensive transport networks which are of great importance and oriented at the outside world, having good cross-country ability within their own territories. This means that TRACECA countries do not need new inland corridors or additional transport routes to the neighboring countries to develop transit traffic. It should be stressed that presently these countries do not need huge investments for the development of the existing transport corridor and its networks. TRACECA transport corridor does already exist and function. TRACECA road routes shown in Figure 12 are as follows: 22routes:

Turkmenabad-Tashkent; 23: Samarkand-Dushanbe/Kulab; 26: Samarkand-Osh/Jalal-Abad; 27: Samarkand-Uchkuduk-Beyneu(in Kazakhstan); 28: Samarkand-Bukara-Beyneu(in Kazakhstan); 25: Tashkent-Osh(in Kyrgyzstan) -Irkeshtam/Torugart(in Kyrgyzstan). Therefore, the project is very significant for all countries located along TRACECA routes. It will lead to economic growth and an inflow of currency.

Figure 12. The Detailed Map of Uzbekistan on TRACECA



3) Inland Logistics Facilities

(1) Logistics company

UZVNESHTRANS, a open state joint stock transport forwarding foreign

economic company(SJSC), has been carrying out its activity in the international forwarding market from 1991[19]. It was re-organized in 1998 as the Republican Self-sustained Foreign Trade Association "Uzvneshtrans" at the Ministry of Foreign Economic Relation of the Republic of Uzbekistan.

The company is an associated member of FIATA and a full member of the Association of International Forwarders of Uzbekistan. The main activities of the company are forwarding services of the Uzbek foreign trade freight in transit, logistic services and services of cargo declaration and insurance. Classification of cargo carried by the company includes: cotton fiber, lint, wheat, flour, chemical fertilizers, nonferrous metals, oil products, industrial equipment, devices, and other products.

The company has 4 representative offices in the regions and 10 subsidiary companies, and is a co-founder of 10 joint ventures, 2 of which are located overseas such as "UzBaltTrans" and "CottonTransServices". "Bukhara Trans Terminal" as a production forwarding company is organized with participation of SJSC "UZVNESHTRANS" and exists in Bukhara. It renders forwarding services for foreign trade cargo including storage reloading, preloading inspection and declaration. Carrying out its activity in the international forwarding market, the company places high emphasis on using alternative transport corridors and new route lines. UZVNESHTRANS consists of five departments: Department of Cotton Fiber Exporting, Department of Non-Cotton Export & Import Operations, Department of Brokerage Services and Customs Declaration, Department of Logistics and Economic Analysis, and Department of Pilot Projects and Small and

19) Interview data provided by "Uzvneshtrans" National Transportation Company.

Medium Business Products Exporting. There are 93 highly experienced specialists at the company.

SJSC UZVNESHTRANS provides transportation services for export/ import cargo with appropriate estimations, development of logistics chain of cargo delivery, choose of route and manner of transportation, warehousing, reloading and sorting. The company uses port facilities of Riga, Liepaya, Ventspils, Klaipeda, Muuga(Baltic), Poti, Batumi(Georgia), Hopa, Mersin (Turkey), Nakhodka(Russia), Ilyichevsk(Ukraine), Bandar Abbas(Iran), with which the company has long-term relations.

The company offers to the cotton fiber purchasers of re-loading and storage of goods within the terminals in the Uzbekistan particularly in Bukhara Cotton Terminal. SJSC UZVNESHTRANS is a founder of this terminal and uses its facilities for processing, warehousing and storage of foreign trade cargo of Uzbekistan. The terminal may store both in routine order and as “Bonded warehouse” and “Free warehouse” environment. The Bukhara Cotton Terminal is fully equipped with all the handling facilities required, and it may store up to 30 thousands ton cotton fiber simultaneously. The important element of the current logistics that allow to provide the complex high-grade transportation services for the optimum prices is a container multimodal transportation from the terminals to end points of destination. It makes a processes of cargo delivery to any recipient much cheaper and faster. In this regard, one of the main tasks of SJSC UZVNESHTRANS is to provide for loading of empty containers.

Chapter 3

CASE STUDIES FOR INLAND DISTRIBUTION

1. Korea

1) Inland Transportation of Cargos

The components of Korea intermodal network can be railways, road, airports, and seaports for transporting cargos. Geographically, Korea is a peninsular country and has been divided at 38 North Latitude into South Korea (Korea) and North Korea since 1945 so that using seaports or airports is only two possible ways to export/import goods. At present, the ports of Busan and Gwangyang act as major gates for sea cargo, and Incheon airport is a primary gate for air cargos. However, Korea is expecting another transportation route after South/North Koreas agreed to link the severed Kyungoui railway line at the Ministerial Meetings on July 31, 2000. This connection of the railway between the both sides will generate Trans-Korean Railway (TKR) which can be linked with the Trans-Siberian Railway (TSR) and Trans-China Railway (TCR). Unfortunately, TKR is not using up to this moment.

In Korea, 99.7% of import/export cargos are distributed via seaports so that they play an important role to connect with inland cities. Korea government has adopted a two-port system which develops and nurtures

both Busan and Gwangyang ports simultaneously. In particular, the port of Busan handled 78.9% of national total cargos including transshipments as of the end of 2003, and 9% is handled by the port of Gwanyang. In 2003, the two ports acting as gateways into inland markets handled 87.9% of Korea's total cargo volume (see Table 14).

Table 14. The Trend of Container Volume at Seaport (TEU)

Port	2000	2001	2002	2003	2004
Busan	7,540,387	8,072,814	9,453,356	10,407,809	11,491,968
Gwangyang	642,230	855,310	1,080,333	1,184,842	1,321,865
Incheon	611261	663042	769791	821071	934,954
Ulsan	236,296	258,468	276,537	318,279	302,870
Others	86,274	140,477	309,781	453,866	471,481
Total	9,116,448	9,990,111	11,889,798	13,185,867	14,523,138

Source: Korea Container Terminal Authority

When container cargos are arrived at the seaports, they can be distributed to inland markets by different transportation modes. In Korea as a peninsular country, the possible ways of inland transport can be railways, roads, or coastal lines. Thus, both Busan and Gwangyang are selected in this study in order to investigate the movement of cargos. The port of Busan handled 6,157,000TEU in 2003 (see Table 15), and the majority of these cargoes are transported by the mode of roads. As a consequence, trucking is a dominant modal choice with 88 % of national cargo volume (see Figure 13). On the other hand, railways and coastal lines take just 10% and 2% respectively. In the similar manner, the port of Gwangyang handled 841,000TEU in 2003 (see Table 16), and 74% of them are transported by the mode of road (see Fingure 13). This indicates that the mode of road is

taking charge of the important role in cargo transportation in Korea. Railway is the second mode of national transport after road.

Table 15. The Volume of Transport by Modes at Busan Port

(Unit: 1000 TEU)

	1999	2000	2001	2002	2003
Total	4,807	5,150	5,310	5,566	6,157
Sea	129	116	119	44	122
Rail	593	650	551	580	636
Road	4,085	4,384	4,460	4,942	5,399

Source: Busan Port-MIS and Korea Railway

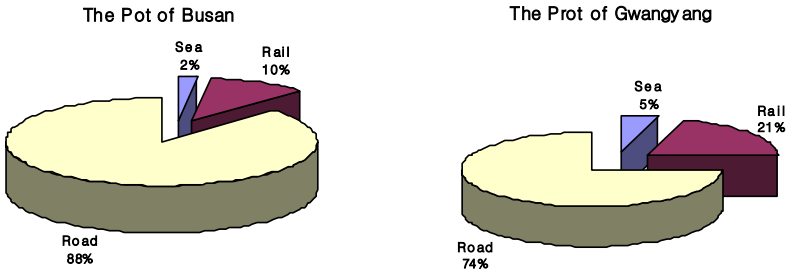
Table 16. The Volume of Transport by Modes at Gwangyang Port

(Unit: 1000 TEU)

Total	386	578	690	766	841
Sea	2	26	44	48	38
Rail	76	146	160	160	172
Road	311	406	486	558	631

Source: Busan Port-MIS and Korea Railway

Figure 13. The Rate of Transport by Modes in 2003



2) Analysis of Cargo Flows

This section will take a close look at the road transportation only since majority of cargos are transported by the mode of road in Korea. A network of expressways in Korea illustrated in Figure 14. Up to date, there is no comprehensive origin/destination data available, so that the actual distribution of containers between ports and inland markets is hardly identified. However, a preliminary survey of Korea Transport Database[20] for origins/destinations of cargos was conducted in 2004 by the Korea Maritime Institute[21]. This means that the reliability of results could be limited. In other words, it is not accurate but whole flows of cargos in Korea could be perceivable.

The preliminary survey was conducted for two weeks from December 15, 2004 to December 29, 2004. The processes of the survey are explained as follow:

(1) Five container ports were selected as places of origins, which handle 95% of national container volume. These were the ports of Busan, Gwangyang, Incheon, Ulsan, and Pyeongtaek.

(2) Origin/destination of all containers transferred through a port are documented for two weeks, where the destination points are classified into fifteen inland markets at level of province or metropolitan cities. These are Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan, Gyeounggi, Gangwon, Chungbuk, Chungnam, Jeonbuk, Jeongnam, Kyoungbuk, and Kyoungnam.

(3) Based on this collected sample data, whole yearly flows of containers are estimated.

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20) The Korea Transport Institute (www.koti.re.kr).

21) The Korea Maritime Institute (www.kmi.re.kr).

(4) The real total volume of cargos at each port from Jan 1, 2004~December 29, 2004 is obtained by Korea Container Terminal Authority.

(5) Finally, the total volume is weighted based on the sample data.

Among the five ports, Busan and Gwangyang are investigated in this analysis.

Figure 14. The Network of Expressways in Korea

(1) The Port of Busan

The port of Busan handled more than 10 million TEU of container volume in 2003 and will be bolstered by 2011 with Busan New Port with 30 berths for 50,000-ton ships. The Busan New Port can handle capacity of 8 million TEU per year. Table 17 shows the construction plan of the port. In addition, the Ministry will create distribution parks in their hinterlands with 132,000m^2 for Gamcheon Port in Busan in 2004. The port of Busan, taking advantage of its well-equipped port infrastructures, will be reborn as an international logistics center. The plan is to develop 726,000m^2 by 2006 and 3,069,000m^2 through 2013 for the distripark at Busan New Port.

Table 17. Construction Plan of the Number of Berths

	Up to 2004	Up to 2006	Up to 2008	Up to 2011
Busan New Port	-	6	18	30

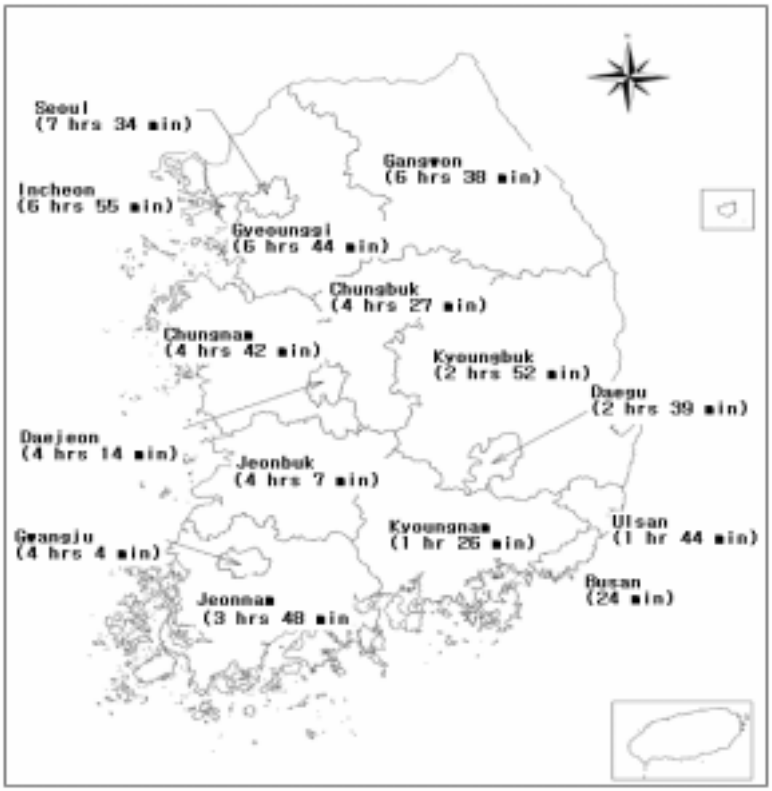
Source: Ministry of Maritime Affairs & Fisheries

According to the data, the flows of containers transported by Busan port are identified in the following manner (see Figure 15). The most high possession ratio was assigned to Kyoungnam with 26.3% of total volume or more than 1.7 million TEU, and the next is Busan 18.3% or about 1.2 million TEU, Gyounggi 12.5% or 823,971TEU, Ulsan 10.9% or 720,703 TEU and so on. With respect to time, the average transit time to inland markets is 4 hours 9 minutes. The longest transportation time is Seoul region with 7 hours 34 minutes illustrated in Figure 16. This indicates that the traffic congestion problem could result in taking longer time than Gangwon region which has relatively poor infrastructure. Next, Incheon

takes 6 hours 55 minutes, Gyounggi 6 hours 44 minutes, and Gangwon 6 hours 38 minutes and so on.

Figure 15. The Rate of Container Traffic via Busan Port

Figure 16. Transportation Time of Containers via Busan Port



(2) The port of Gwangyang

The port of Gwangyang, a potential major northeast port with 35 percent annual growth in cargo volume, will be developed to become a leading international port, equipped with 33 berths for large container ships. Table 18 shows the construction plan of the port. In addition, the Ministry will create distribution parks in their hinterlands. The port of Gwangyang will host not only logistics enterprises but also manufacturers so as to establish itself as a center of manufacturing and logistics, and is planning to develop 330,000m^2 by 2006 and 4,026,000m^2 through 2011.

Table 18. Construction Plan of the Number of Berths

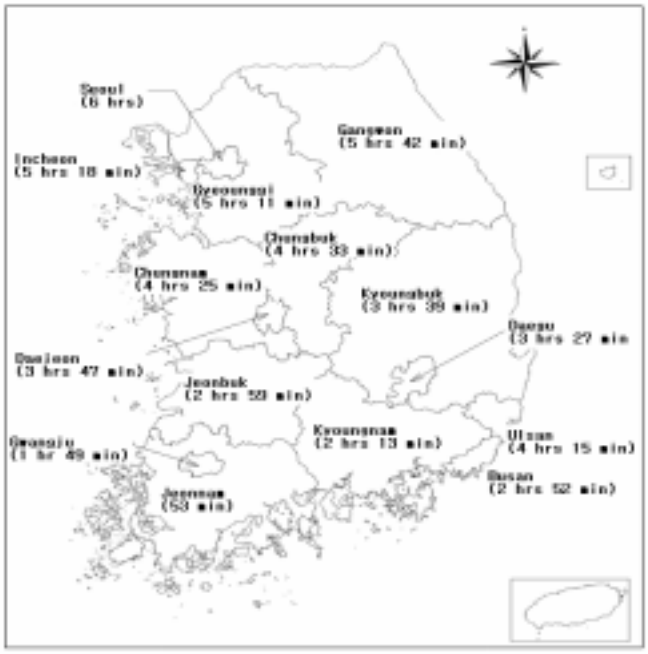
	Up to 2004	Up to 2006	Up to 2008	Up to 2011
Port of Gwangyang	12	16	19	33

Source: Ministry of Maritime Affairs & Fisheries

For the port of Gwangyang, the flows of containers are also identified illustrated in Figure 17. The most high possession ratio is assigned to Jeonnam with 49.4% of total volume or 484,911 TEU, and the second area is Gwangju 16.5% or 162,368 TEU, Jeonbuk 12.9% or 127,004TEU, and so on. In addition, the average transit time to inland markets is 3 hours 49 minutes. The longest transit time is the Seoul region with 6 hours illustrated in Figure 18. The next is Gangwon 5 hours 42 minutes, Incheon 5 hours 18 minutes, and Gyunggi 5 hours 11 minutes.

Figure 17. The Rate of Container Traffic via Gwangyang Port

Figure 18. Transportation Time of Containers via Gwangyang Port



3) Summary

Currently, most of containers are distributed into inland markets by the use of Busan port except Gwangju and Jeonnam areas (see Table 19). However, the transit time can be saved in case of using Gwangyang port when the cargos heading to Daegu, Ulsan, Chungbuk, Kyoungbuk, and Kyoungnam are considered (see Table 20). Even though Gwangyang has an advantage of delivery time, many shippers are still likely to use Busan. This might in part because Busan port has been operated over 30 years, but Gwangyang is just about 3 years. Thus Busan has become one of the world's largest maritime

center and been offering a wide range of services, including maritime law, finance, insurance, shipbroking, ship classification, ship surveying, arbitration, and banks with specialist shipping desks.

Table 19. Comparisons of the Flows of Containers at Both Ports (TEU)

Destination	From Busan		From Gwangyang		Difference
	Volume(A)	Percentage	Volume(B)	Percentage	A-B
Seoul	191,581	2.9	415	0.0	191,166
Busan	1,205,411	18.3	35,934	3.7	1,169,477
Daegu	172,118	2.6	625	0.1	171,493
Incheon	167,133	2.5	2,695	0.3	164,438
Gwangju	92,614	1.5	162,368	16.5	-69,754
Daejeon	720,703	1.4	12,820	1.3	707,883
Ulsan	823,703	10.9	3,131	0.3	820,572
Gyeounggi	823,971	12.5	72,727	7.4	751,244
Gangwon	22,360	0.3	1,134	0.1	21,226
Chungbuk	107,600	1.6	24,941	2.5	82,659
Chungnam	171,977	2.6	27,879	2.8	144,098
Jeonbuk	154,716	2.3	127,004	12.9	27,712
Jeonnam	207,081	3.1	484,911	49.4	-277,830
Kyoungbuk	717,248	11.0	1,639	0.2	715,609
Kyoungnam	1,733,946	26.3	23,957	2.4	1,709,989
Total	7,312,162	100	982,180	100	N/A

In terms of transit time, Korea is not a big country so that most of cargos can be distributed within maximum 7 hours 34 minutes. That is why road transportation is a dominant mode for inland distribution. In general, trucking is widely used for the shipments of semifinished and finished products with an average length of freight haul of 646 miles for less than truckload and 274 miles for truckload. The inherent advantages of trucking are its door-to-door service so that no loading or unloading is required between origin

and destination. And, trucking can offer reasonably fast and dependable delivery. However this high reliance on the road transportation can bring about increase of air pollution, energy consumption and traffic accident, etc.

In Korea, there is not much transit time difference between Busan and Gwangyang for transporting cargos to the areas of Seoul, Incheon, Daejeon, Gyeonggi, Ganwon, Chungbuk, Chungnam, Kyoungnam, and Kyoungbuk. Other areas such as Busan, Gwangju, Ulsan, Jeonbuk, Jeonnam are closely located in Busan or Gwangyang so that there could be preference to use a particular port. In terms of ITPM, either Busan Port or Gwangyang Port can be used for representing an entry port of the Korea for inland distribution. This implies that a single port as a main gate of inland distribution is enough for a small country whose cargos are able to be delivered within about 8~10 hours (or distance of about 646 miles) from the port to inland sites.

Table 20. Comparisons of the Distribution Time at Both Ports

Destination	Busan(A)	Gwangyang(B)	A-B
Seoul	7 hrs 34 min	6 hour	1 hr 34 min
Busan	24 min	2 hrs 52 min	-2 hrs 28 min
Daegu	2 hrs 39 min	3 hrs 27 min	- 48 min
Incheon	6 hrs 55 min	5 hrs 18 min	1hr 37 min
Gwangju	4 hrs 4 min	1 hrs 49 min	2 hrs 15 min
Daejeon	4 hrs 14 min	3 hrs 47 min	27 min
Ulsan	1 hrs 44 min	4 hrs 15 min	- 2 hrs 31 min
Gyeounggi	6 hrs 44 min	5 hrs 11 min	1 hr 33 min
Gangwon	6 hrs 38 min	5 hrs 42 min	56 min
Chungbuk	4 hrs 27 min	4 hrs 33 min	- 6 min
Chungnam	4 hrs 42 min	4 hrs 25 min	17 min
Jeonbuk	4 hrs 7 min	2 hrs 59 min	1 hr 8 min
Jeonnam	3 hrs 48 min	53 min	2 hr 55 min
Kyoungbuk	2 hrs 52 min	3 hrs 49 min	-57 min
Kyoungnam	1 hrs 26 min	2 hrs 13 min	-47 min

2. China

1) Inland Transportation of Cargos

(1) Yangtze River

The inland waterways of China are dominated by the Yangtze River which stretches 55,300 km and accounts for over half of China's total river course. Shanghai is situated at one end of the river whilst the fast growing city of Chongqing is located in the upper navigable reaches. Along its course there are about twelve ports capable of shipping containers although most traffic occurs on the lower reaches between Shanghai and Nanjing. Of twelve ports along the Yangtze river, seven inland ports are considered in this study, and their locations and throughput are roughly described in Figure 19. Based on 2004 data provided by Regional Port Administration Bureau of China, total trade volume of this area amounted to 1,310,900 TEU. This includes import/export cargos as well as movements between inland ports so that the real volume could be reduced.

The main navigable stretch of the Yangtze river covers the 2,500km from Shanghai to Chongqing, running through the heart of central China. The regions linked by Yangtze include 7 provinces and 2 cities such as Sichuan province, Hubei province, Hunan province, Anhui province, Jiangxi province, Jiangsu province, Shejiang provinces, Shanghai municipality, and Chongqing municipality. With regard to the regional economy[22], the 2003 GDP for the these areas reached $ 4,601 billion, or 39.0 % of the national total, and the trade volume accounted to $ 204 billion, accounting 32.8 percent (see Figure 20).

22) The National Bureau of Statistics of China (http://www.stats.gov.cn/english/).

Figure 19. Major Ports along the Yangtze River

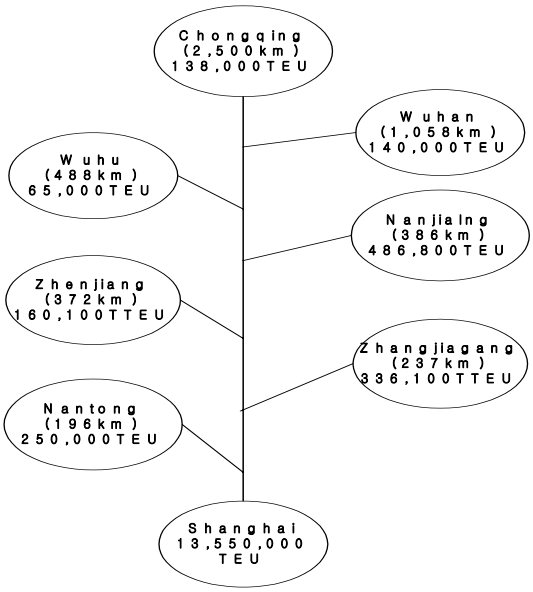
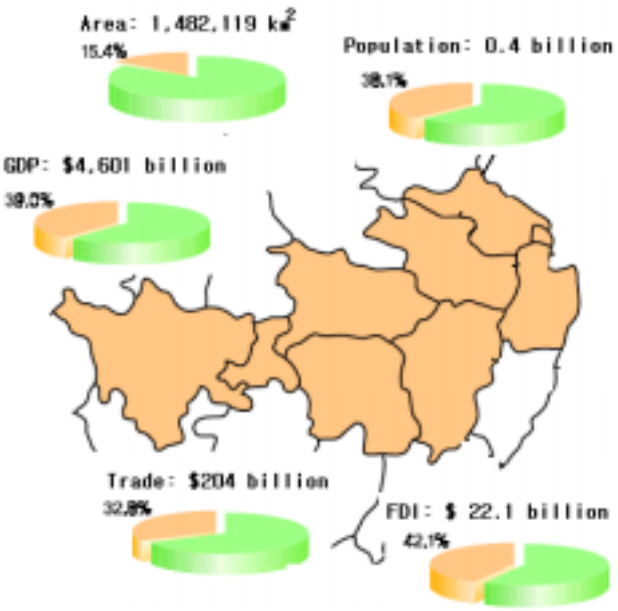


Figure 20. Economic Indicators along Yangtze River



(2) Barge Operation

In the Yangtze river, barge service is the main transportation mode, and more than 1,500 barge operators are running. However, only ten operators of them are leading the market[23]. Table 21 shows the profile of ten leading barge operators.

Table 21. The Summary of the Major Ten Barge Operators

Name of Operator	Fleet (TEU)	Owner	Service Area
Cosco International Freight Co., Ltd	182,000	Cosco	All Area
Shanghai Jihai Shipping Company	163,000	Shanghai Port Containers Co.	All Area
Shanghai Puhai Shipping Company	107,000	China Shipping	All Area
Penavico Shanghai	87,000	Penavico	All Area
Minsheng International Freight Co., Ltd	70,000	Private Enterprise	All Area
Sinotrans Changjiang Shipping Co., Ltd	64,000	Sinotrans	Middle to Down
Jiangsu Univill Logistics Co., Ltd	53,000	Private Enterprise	Jiansu Province
Jiangsu Ever-rich Logisics Co., Ltd	43,000	Private Enterprise	Jiangsu Province
Jiangsu Marine	33,000	Private Enterprise	Jiangsu Province
Jiangsu Kaitong	33,000	Private Enterprise	Jiangsu Province

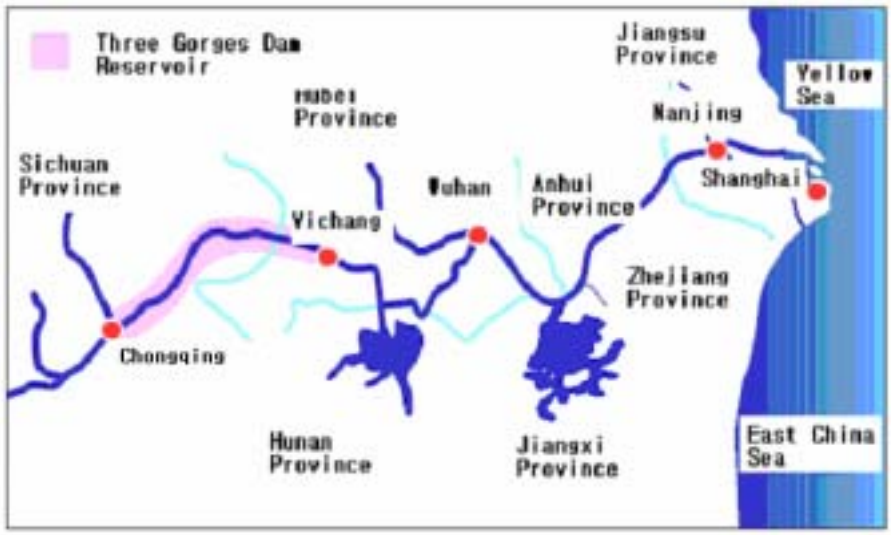
Source: Carriers & Forwarders

Ships as large as 2,500-tonnes can sail to Nanjing from Shanghai, taking 1~2 days Ships up to 5,000-tonnes can sail to Wuhan, but 10,000-tonnes is possible when water level is high especially in summer season, The transit time from Shanghai to Wuhan is 3~5 days larger freight ships can travel as far as Chongqing with the completion of Three Gorge project. The transit time form Shanghai to Chongqing usually takes 7~10 days[24]. Its geographical

23) Interview data provided by Korean/Chinese forwarders and carriers.
24) Interview data provided by Korean/Chinese forwarders and carriers.

description is illustrated in Figure 21.

Figure 21. The Geographical Description along the Yangtze River



(3) Yangtze River Delta

Within the Yangtze River Delta region, Shanghai is developing Waigaoqiao, Pudong Airport and Northwest Shanghai (Xibei) logistics parks. Xibei is located on a main communications route through which goods from Shanghai are distributed to the Yangtze River Delta region and inland provinces. At present, 936 logistics enterprises are operating in the Xibei park with a total warehousing area of 600,000m^2. Tenants of the park include companies such as APW of the US, Schneider of France, Marubeni of Japan, T. Join of Taiwan, Dazhong Transportation, Hualian Distribution Centre and PG Logistics. The other two logistics parks have also attracted international players such as APL, Maersk, Marubeni, UPS, FedEx, TNT and DHL.

Overall, services on the Yangtze accounted for about a third of all containers shipped on China's inland waterways and coastal shipping in 2001. Port volumes are growing by up to 25% a year due to increased economic activity at ports and cities along the river. It is forecast that the Yangtze could move up to 300 million tonnes of goods by 2010, and this compares with 186 million tonnes in 1999. By 2020 it is hoped that ocean going ships will be able to sail to western regions directly. Despite the potential for using the river for a larger proportion of goods movement, there has been little investment in the mode over the last 25 years.

However, the fact that the Yangtze provides a direct link to the west of the country could result in a renewed interest due to the government's desire to open up this region to economic development. The largest operator on the Yangtze is Changjiang Group which accounted for 46% of the total cargo carried on the river in 1999[25].

(4) Modeling a Distribution Network

Despite of the China's Go West policy initiated in the late 1990s, the West region remains largely unfulfilled. However, many companies are having an interest in the West region in order to take advantage of relatively low labor and land costs. In this regard, Yangtze river can become a major manufacturing base and a corridor by connecting the costal regions of commerce centers such as Shanghai to interior provinces.

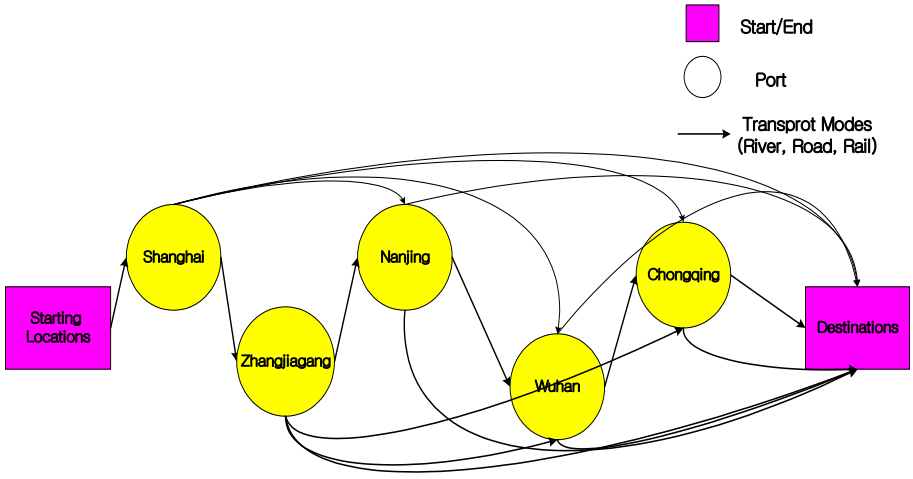
In general, transportation problem plays an important role for economic development and growth of any region. An efficient logistics infrastructure provides low logistics costs so that there are many opportunities to attract

25) China Logistics Report 2004, Transport Intelligence Ltd, October 2004.

investment capital into cities. Thus, reducing the cost and improving the quality of logistics and transport system improves international market access and leads directly to increased trade. By doing this, higher incomes and the scope for significant reduction in poverty can be achieved. Consequently, this case study will investigate an efficient transport route for 9 areas along the Yangtze river.

The network structure of this model is illustrated in Figure 22, where nodes refer to major ports (Shanghai Port, Zhangiagang Port, Nanjiang Port, Wuhan Port, Chongqing Port) along the Yangtze river, a place of origin, and a destination point. Shanghai Port is selected as a starting point for transporting imported cargos into inland cities. Shanghai Port, the largest in the Chinese mainland, has handled more than 14 million TEU in 2004, and this makes Shanghai Port the third largest container port in the world. One inland city as a destination location is selected from each province. The components of intermodal network along the Yangtze river can be rail, road, river, and ports.

Figure 22. A Network Structure of the Yangtze River Model



Based on the network structure, the Shortest Path model can be constructed by considering a directed network with *n* nodes. The decision variables are x_{ij}, the flow through arc (i,j). The given information includes:

- c_{ij}: cost per unit of flow from i to j,
- t_{ij} : time of flow from i to j,
- a : a weight coefficient.

The objective is to minimize the weighted total cost and time of transporting cargoes through the network. The linear programming formulation for this problem is:

$$\text{Minimize} \quad \sum_i \sum_j \{ac_{ij} + (1-a)t_{ij}\}x_{ij} \tag{1}$$

$$\text{Subject to} \quad \sum_j x_{ij} = 1 \text{ for the starting node i,} \tag{2}$$

$$-\sum_j x_{ji} = -1 \text{ for destination node i,} \tag{3}$$

$$\sum_j x_{ij} - \sum_j x_{ji} = 0 \text{ for other node i} \tag{4}$$

$$0 \le a \le 1 \tag{5}$$

$$x_{ij} \ge 0 \text{ for all i and j} \tag{6}$$

This model has the objective (1) of minimizing the total sum of weighted cost and time. Constraint (2) assures that a flow from a starting node should be made. Constraint (3) guarantees that a flow to a destination should be satisfied. Constraint (4) preserves the balance from and to each node. Constraint (5) ensures that a weight coefficient lies between 0 and 1. Constraint (6) preserves the non-negative restrictions on the decision variables.

2) Analysis of Cargo Flows

(1) Model Applications

As mentioned, the regions concerned in this research include 7 provinces and 2 cities such as Sichuan province, Hubei province, Hunan province, Anhui province, Jiangxi province, Jiangsu province, Shejiang provinces, Shanghai municipality, and Chongqing municipality. Railways, roads, and Yangtze river could be principal modes of transport for accessing those places. In order to find efficient routes for those regions, one city was selected from each region and the Shortest Path model was applied. The transportation costs and time used in the model were collected a number of sources such as shippers, forwarders, and 3PLs, but there were high variability depending on types of businesses. Thus, modified values were used for the model analysis.

The model was run under three different scenarios. The first one was based on only cost criteria, minimizing total transportation costs; the second was developed to minimize the total transit time the; third one took into account both cost and time by the use of weight coefficient where there could be a large number of combinations. In order to get an appropriate ratio of cost to time, a couple of interviews with experts in shipping industry were conducted. Based on this data, it was approximately determined that cost and time were in the ratio of 0.8 to 0.2.

After running the models, Table 22 shows the summary of the optimal routes for the three cases and their total transportation costs and time are summarized in Table 23. The results indicated that using barge services along Yangtze river was identified to be an efficient way of transport in terms of cost minimization criteria. At the same time, it was found that the

solution applied by multiple criteria using cost and time was identical to that of the cost criteria model when the ratio of 0.8 to 0.2 was set. However, as the ratio changed, the solutions were also varied. With respect to time minimization criteria, the use of road was apparently the fastest way of transport but shipping cost was very high. Additionally, it was noticed that Chongqing Port, Whuna Port, and Nanjing Port could act as important transshipment sites for inland transportation. Figure 23 illustrated an overview of distribution plan based on the results of multiple criteria model.

Table 22. The Summary of Optimal Routes

Destination	Criteria	Optimal Routes
Chengdu (Sichuan)	Cost	Shanghai-(water)-Chongqing port-(rail)-Cheongdu
	Time	Shanghai-(road)-Cheongdu
	Multiple	Shanghai-(water)-Chongqing port-(rail)-Cheongdu
Chongqing (Chongqing)	Cost	Shanghai-(water)-Chongqing port-(rail)-Chongqing
	Time	Shangha-(road)- Chongqing
	Multiple	Shanghai-(water)-Chongqing port-(rail)-Chongqing
Changsha (Hunan)	Cost	Shanghai-(water)-Wuhan port-(rail)-Changsha
	Time	Shanghai-(road)-Changsha
	Multiple	Shanghai-(water)-Wuhan port-(rail)-Changsha
Xiangfan (Hubei)	Cost	Shanghai-(water)-Wuhan port-(rail)-Xiangfan
	Time	Shanghai-(road)- Xiangfan
	Multiple	Shanghai-(water)-Wuhan port-(rail)-Xiangfan
Nanchang (Jiangxi)	Cost	Shanghai-(water)-Nanjing-(rail)-Nanchang
	Time	Shanghai-(road)-Nanchang
	Multiple	Shanghai-(water)-Nanjing-(rail)-Nanchang
Hefei (Anhui)	Cost	Shanghai-(water)-Nanjing-(rail)-Hefei
	Time	Shanghai-(road)-Hefei
	Multiple	Shanghai-(water)-Nanjing-(rail)-Hefei
Quzhou (Zhejiang)	Cost	Shanghai-(rail)-Quzhou
	Time	Shanghai-(road)- Quzhou
	Multiple	Shanghai-(rail)-Quzhou

Multiple refers to the ratio of cost (=0.8) to time (=0.2)

Table 23. The Summary of the Costs and Time for the Three Scenarios

From Shanghai To	Province	Cost		Time		Multiple	
		Cost($)	Time(hr)	Cost($)	Time(hr)	Cost($)	Time(hr)
Chengdu	Sichuan	555	275	5,000	187	555	275
Chongqing	Chongqing	453	310	4,590	160	453	310
Changsha	Hunan	530	282	2,400	150	530	282
Xiangfan	Hubei	580	292	2,400	150	580	292
Nanchang	Jiangxi	550	216	2,200	100	550	216
Hefei	Anhui	265	131	500	35	265	131
Quzhou	Zhejiang	110	30	180	25	110	30

Multiple refers to the ratio of cost (=0.8) to time (=0.2)

Figure 23. The Graphical Description of an Intermodal Distribution Network

(2) Major River Ports

As mentioned, Chongqing Port, Whuna Port, and Nanjing Port could act as important transshipment places for inland transportation. The detail information of those ports are obtained by field trips. First, Chongqing port is located in the mid-west of China, Chongqing port is the main inland port which is the biggest one in the upper reach of the Yangtze River[26]. This port is also linked through railways of Chengdu-Yu (Chongqing), Xiang (Ankang)-Yu, Yu-Qian(Guizhuo), and Yu-Huai(Huaihua), and the freeways of Cheung-Yu, Yu-Qian, Chongqing to Wuhan, and Chongqing to Changsha. This port offers a large range of management service: loading and discharging cargo in port, embarking passengers and cargos, transferring between waterway and landway, storage agency, logistics distribution, and tourism. Its throughput of cargo reaches 9 million tons a year and the passengers going there nearly 10 million a year. It has 114 berths with covers 350,000 m^2 storing areas. An international container occupation wharf whose total handling ability reaches 100,000TEU a year, and an automobile roll on-off wharf whose handling ability is 100,000 autos. Chongqing port has totally freight wharfs and 17 passenger transport wharfs , whose capital is 1.8 billion yuan, and is operated by Chongqing Prot Group Co., Ltd.

Second, Wuhan Port is located in the middle reaches of Yangtze River, Wuhan is one of the most important inland river ports along the river[27]. It is also home to the headquarters of organizations and corporations in relation with Yangtze River navigation and shipping. Wuhan Port is an open port ranked as Class 1 of Chinese classification along the Yangtze River.

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26) Interview data provided by Jiulongpo Port.

27) Interview data provided by Wuhan International Container Transshipment Co. Ltd. & www.wuhanport.com.

This port can handle vessels up to 3,000~5,000 tones capacities. Frequent feeder service is available between Wuhan and ports along the Yangtze River to Shanghai and Chongqing. The port handles up to 900,000 tonnes in general cargo and 25,000 TEU of container traffic a year. The total port area is 122.45 ㎢, of which, the land area is 1.75 ㎢. There are four cargo loading/unloading areas and one passenger transport area. Since April 2002, the Wuhan port has been decentralized to Wuhan municipal government, and Wuhan Port Group is recently established for the port administration. Local government will have more say in the port infrastructure and daily operation, and it will be more difficult for the port to get financial support from central government for its infrastructure construction.

Third, Nanjiang Port is located in the lower reaches of the Yangtze River, Nanjiang is open to navigation for 35,000-ton ships all the year[28]. After completion of the dredging project of the estuary and lower-reaches waterway of the Yangtze River, Nanjing Section of the Yangtze River will be navigable to over 50000 tons. The port is a multifunctional sea-river port for the collection and distribution of cargos along the Yangtze River and in the Yangtze Delta. It provides river/sea transshipment and water/land transshipment with an annual cargo throughput of over 60,000,000 tons. In 2002, its throughput exceeded 300 thousand TEU and in 2003, it will exceed 400 thousand TEU, maintaining its position as the biggest port along the Yangtze River in container transportation. It has eighteen 10,000-dwt wharfs, fifty-two 1,000-dwt wharfs and 16 buoy berths; there are 59,338㎡ warehouses, 477,878㎡ storage yards, and an 18km port railway. This port owns the largest port areas for petrochemical, container, coal and foreign trade along the Yangtze River.

28) Interview data provided by the port of Nanjing.

In order to meet the requirements of rapid development of container transportation, the Longtan Port Project, Phase I has been commenced after obtaining approval from the Central Government of the State. The project will lay emphasis on building three 25,000-ton-level (with the hydraulic structures satisfying the requirements of 50,000 tonners) container berths and two berths under 10,000-ton level. The designed throughput capacity is 520,000 TEU and the total investment in the project will be 1.1 billion Yuan. It is expected to be put into production at the end of 2003. By that time, as the container businesses at Xinshengwei will be transferred to Longtan Port Area. As a special container port that is the largest in scale and highest in level of modernization among all ports in the Yangtze Valley. Longtan Port will become a gateway for trade and a transit base of Nanjing and areas in the middle and upper reaches of the Yangtze River.

3) Summary

The Yangtze river can be divided into three major segments. The first section of the Yangtze river covers from Shangai to Nanjing reaching 386km, where Anhui province and Shejiang Province are covered by Nanjing Port. Currently majority of the river's transport takes place in this section due to the better river conditions. The Yangtze River Delta accounted for 23.5% of China's industrial production in 2002 and 17.2% of the gross domestic produc t[29]. Many foreign manufacturers are located in some of the delta cities such as Suzhou, Wuxi, and Hangzhou. In particular, a large chemical park is located at Nanjiang and is only 25km away from the Nanjiang Port. This park also

29) China Logistics Report 2004, Transport Intelligence Ltd, October 2004.

conveniently liked by expressways and a rail line.

The second section stretches from Nanjiang to Wuhan covering 672km. Wuhan Port covers Hubei province, Hunan province and Juanxi province. Navigation is better than the first section and Wuhan can handle vessels up to 5,000 dwt. Manufacturing is more diverse and many Japanese companies are located in this area.

The final section stretches from Wuhan to Chongqing covering 1,442km. In particular, this section has the three gorges reservoir and its first stage was completed in 2004. This is the least developed part of the river. In addition, Chongqing became a municipality in 1997, and is the world's largest city with a population of 31 million. This city has much potential for both consumers and manufacturing bases using the river after the three gorges project is completed especially with navigational improvements.

In addition, the intermodal transport option obtained by the mathematical model of multiple criteria is compared with other single modes of transportation. Table 24 shows the summary of the three alternatives where Multiple refers to the solution obtained from the mathematical model with the ratio of cost (=0.8) to time (=0.2).

Table 24. The Comparisons of the Three Alternative Routes

From Shanghai To	Province	Multiple		All Rail		All Road	
		Cost($)	Time(hr)	Cost($)	Time(hr)	Cost($)	Time(hr)
Chengdu	Sichuan	555	275	700	220	4,440	144
Chongqing	Chongqing	453	310	690	200	4,320	144
Changsha	Hunan	530	282	850	240	4,070	120
Xiangfan	Hubei	580	292	610	185	2,350	120
Nanchang	Jiangxi	550	216	580	170	1,010	72
Hefei	Anhui	265	131	300	85	640	24
Quzhou	Zhejiang	110	30	110	30	470	24

In terms of cost, the mode of all road transport is very expensive option comparing to all railways and an intermodal route (see Figure 24, 25). Especially the areas of China's inland provinces located far from seaport have disadvantages of higher transportation costs so that intermodal transport option of using railway or rivers is highly desirable. For example, the transport costs of Chenngdu, Chongqing, Changsha, and Xiangfan are more than five times compared to their optimal solutions. In particular, the model of all railway transport along the Yangtze river is not a good alternative since the transit time of railways from Shanghai to Changsha, Xiangfan, Nanchang, Hefei, or Quzhou take longer than barge-railway intermodal transport option. This means that the railway transport system along the Yangtze River is not well developed.

As a result, developing organized railway systems or river transportation is essential to develop the economies of the China's inland provinces. Additionally, a developing country like China has to consider the issue of availability of transport modes when designing the ITPM since this country does not have enough transportation infrastructures.

Figure 24. The Cost Comparisons of Three Alternatives

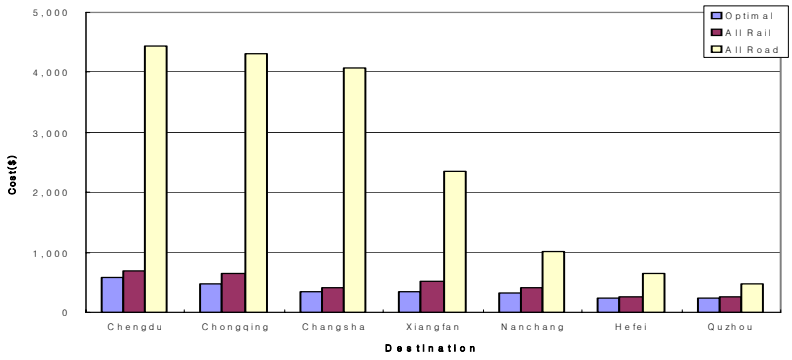
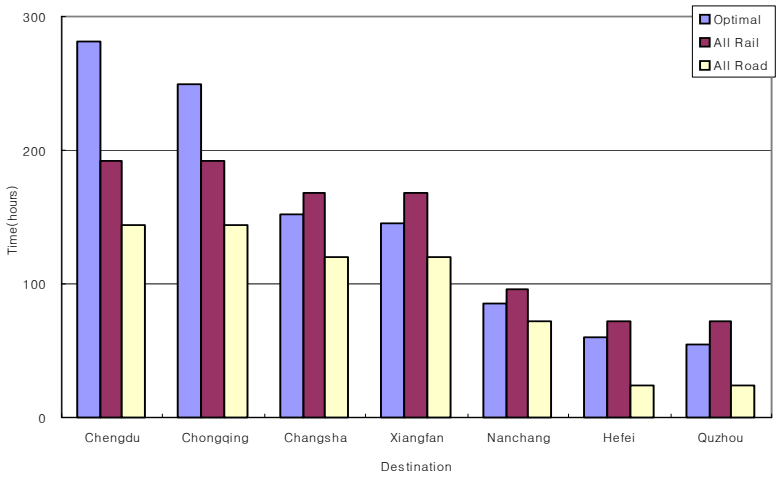


Figure 25. The Time Comparisons of Three Alternatives



3. Uzbekistan

1) Inland Transportation of Cargos

Uzbekistan is doubly landlocked country so that exported/imported goods often transit through more than one neighboring country on the way to final destinations. The major import/export partners of Uzbekistan are in West Europe and Asia. Uzbekistan can thus be reached by the major seaports on the Pacific, Black Sea, Baltic Sea, Persian Gulf, and Mediterranean Sea. In Uzbekistan, rail and road could be the only surface transport modes. In particular, road transport is in poor condition and there are few trucks so that railways could be a more economic and faster means of international freight transportation. The length of possible railways routes which connect

Uzbekistan with major seaports on these mentioned above ranges between 3,800km and 6,320km based on origin or destination. The distances from a port to Tashkent as destination point are shown in Table 25. As a result, a number of transport routes can be available by the use of railways and roads.

Table 25. Transport Routes between Tashkent and Major Seaports

Area	Port	Distances (km)
Pacific	Shanghai	About 6,320
	Lianyungang	
	Qingdao	
	Vladivostock	8,800
Black Sea	Novorossiysk	3,950
	Poti-Baku-Aktau	3,900
Baltic Sea	Riga	5,500
Persian Gulf	Bandar Abbas	3,800
Mediterranean Sea	Mersin	4,421

Source: Interview material from field trip

2) Analysis of Cargo Flows

(1) Rail Transportation

Rail transport competes with road transport sector, where transport operators arrange shipment for the import of goods using one or more covered wagon. In this regard, rail transport can offer a competitive alternative with respect to price. For example, shipments from Istanbul to Tashkent with a wagon with capacity of 53 tons in 2003 cost about $7,500,

but a truck capacity of about 30 tons costs of about $6,000. In addition, the transit time of conventional rail transport lies between 30 to 35 days for a single wagon[30]. It seems less efficient. However, the reliability of railways is considered to be high in case of avoiding break-of-gauge points. If the cargo is transported between wagons of different gauge along the land route form Turkey via Moldova, pilferage could be expected. There exist a couple of break-of-gauge points which are located at Drushba/Alashankou at the border of China and Kazakhstan, Sarakhs at the border of Turkmenistan and Islamic Republic of Iran, and Brest at the border of Belarus and Poland. These could cause operational hindrances but do not cause critical delays compared with waiting time and delays at border crossing points.

According to Korean carriers and forwarders, there are currently four different routes available from ports in the Pacific to Tashkent, and their rough breakdowns of cost and time of a 20-foot container for each route are shown in Table 26. They also reported that most of shipments had been transported by the use of Route 1, Route 2, or Route 3. On the other hand, Route 4 that is using the port of Bandar Abbas in Iran is not a competitive alternative since average transit time and cost take 52 days and $4,200 respectively. However the average transit times of Route 1, Route 2, and Route 3 are 27 days, 28 days, and 28 days. In terms of transportation costs, these are $2,600, $2,650, and $2,650 respectively.

In addition, the average transfer time at the border between different countries is reported to be 2.5 days. However, Daewoo Corporation in Korea, for example, mentioned that transit time less than current one at the border of China and Kazakhstan could be achieved from its experience. It

30) Transit Transport Issues in Landlocked and Transit Developing Countries, United Nations, New York 2003.

means that there exist much opportunities to reduce transit time. Meanwhile, freighter operations have reported a couple of reasons of transportation delay at the border of China and Kazakhstan[31]. First, due to break-of-gauge, the operation of transshipment should be implemented where at the time of transfer, the shortage of wagons of Russia or CIS countries cause the delay of the shipments; geographical characteristics at Alashankou(China) /Druzba(Kazakhstan) especially in summer season bring some delays because of strong wind; third, the type of China' wagon is Paylod 40 Tons so that the total number of containers should be even to run. Accordingly this causes delay in order to make a pair.

Table 26. Transport Time and Costs for Four Routes

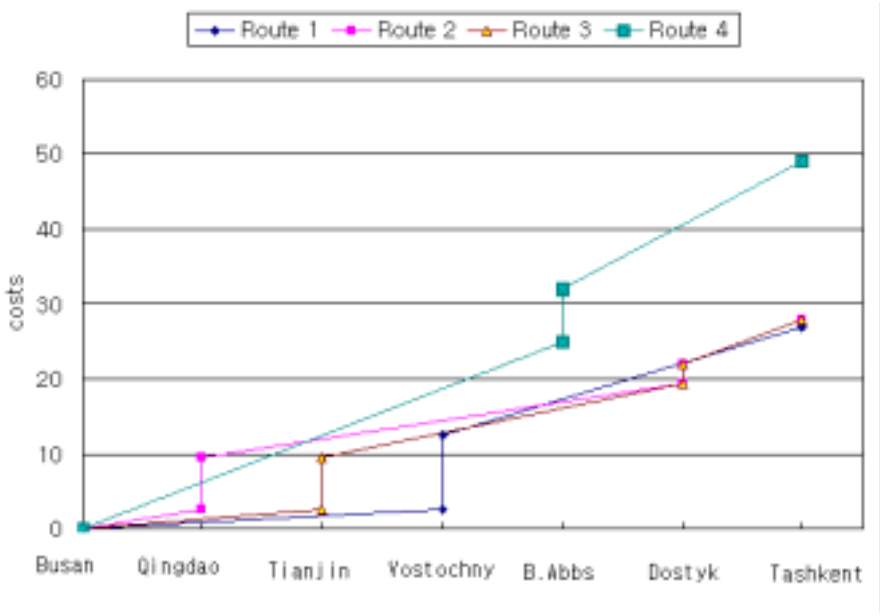
Route 1	Transport Mode	Average transit Time (days)	Cumulative Time(days)	Average Cost ($)	Cumulative Cost($)
Busan		0	0	0	0
Busan-Vostochny	Sea	2.5	2.5	800	800
Vostochny		10	12.5	100	900
Vostochy-Tashkent	Rail	14.5	27	1700	2600
Route2					
Busan		0	0	0	0
Busan-Qingdao	Sea	2.5	2.5	250	250
Qindao		7	9.5	100	350
Qindao-Dostyk	Rail	10	19.5	1000	1350
Dostyk		2.5	22	100	1450
Dostyk-Tashkent	Rail	6	28	700	2650
Route 3					
Busan		0	0	0	0
Busan-Tianjin	Sea	2.5	2.5	250	250
Tianjin		7	9.5	100	350
Tianjin-Dostyk	Rail	12	19.5	1000	1350

31) Data provided by Korean carriers and forwarders.

Dostyk		2.5	22	100	1450
Dostyk-Tashkent	Rail	6	28	1200	2650
Route 4					
Busan		0	0	0	0
Busan-B. Abbas	Sea	25	25	1600	1600
B. Abbas		7	32	100	1700
B. Abbas-Tashkent	Rail	20	52	2500	4200

Source: Data collected from Korean carriers

Figure 26. Average Cumulative Transit Time for the Four Alternative Routes



(2) Road Transportation

In Uzbekistan, road transport is primarily used for connecting Western Europe, Turkey, and Russian Federation. Truck operators in Uzbekistan prefer the southern routes to reach EU with an average transit time of about 432 hours (20 days). Road connections between Central Asia to the east and south are less developed. There is one major paved road corridor, linking

Tashkent to Almaty. Currently, road networks are adequate in the sense of linking major cities and commercial and industrial centers. In particular, the roads were not built to support the heavy volume of trucks. The demand for transport was reduced dramatically after the five Central Asia republics became independent and the collapse of Soviet. The volume of freight traffic fell rapidly by 67 percent in Uzbekistan[32].

Overall transport time for road transport between Uzbekistan and Europe varies between 10 to 20 days based on the transport route. Factors influencing the road transport time are border crossing procedures, regulations for issues of visas, customs transit regulations, control stops by traffic police, and poor road conditions.

The data on distance, time, and cost from Berlin to Tashkent is shown in Table 27. Road transit time on the routes is 432 hours, and 96 hours of transit time is spend on waiting a border crossing point between Uzbekistan and Turkmenistan. This waiting time could be reduced to a reasonable level compared with other border crossing points. In detail, it took 1 day between Turkmenistan and Iran and 0.5 day between Iran and Turkey. Road conditions may influence the average driving speed of the trucks in various countries. The average speed is an indicator of road conditions so that improving road transport infrastructure could be an important to achieve the economic benefits of faster road transport.

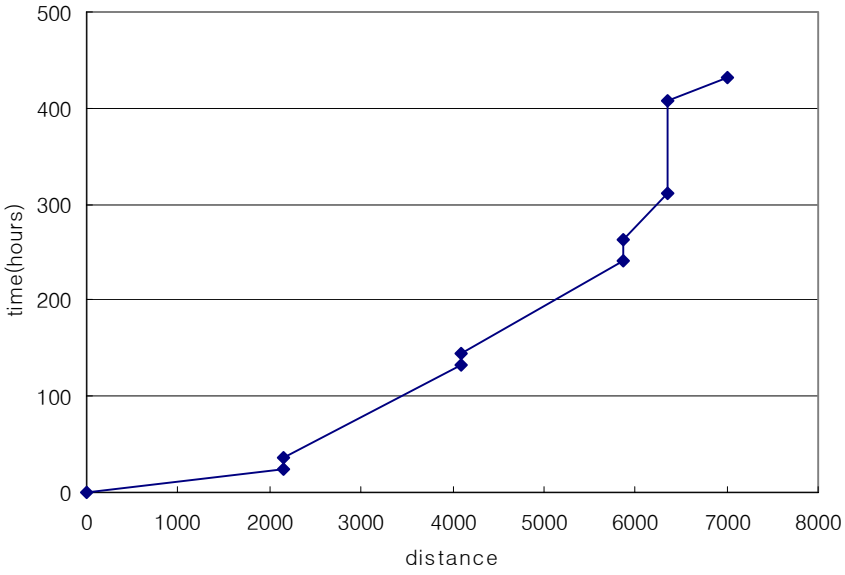
32) Transit Transport Issues in Landlocked and Transit Developing Countries, United Nations, New York 2003.

Table 27. Distance, Transport Time and Cost from Tashkent-Berlin

Transport Leg	Cum. Dis. (km)	Time (hrs)	Cum. Time(hrs)	Cost ($)	Cum. Cost($)
Berline(Germany)	0	0	0	0	0
Berlin(Germany)-Kapikule	2150	24	24	1000	1000
Kapikule	2150	12	36		1000
Kapikule- Barzargan	4090	96	132	2000	3000
Barzargan	4090	12	144		3000
Barzargan(Turkey)- Sarakhs	5870	96	240	1800	4800
Sarakhs	5870	24	264		4800
Sarakhs(Iran)- Alat/Farab	6350	48	312	500	5300
Alat/Farab	6350	96	408	1000	6300
Alat/Farab(Turkmenistan)- Tashkent	7000	24	432	750	7050

Source: Data collected by ESCAP staff. (Cum=cumulative, Dis=distance)

Figure 27. Cumulative Transit Time for the Tashkent-Berlin



From the Korean ports in the sea routes, there exists only one route according to according to Korean carriers and forwarders shown in Table 28. They also mentioned that owing to high transportation costs, this was not frequently used for the cargos heading to Uzbekistan. However, this route was mainly designed for transporting cargos to the area of CIS such as Armenia, Georgia, Azebaijan, and Turkmenistan, etc

Table 28. Transport Time and Costs from Busan-Tashkent

Route	Transport Mode	Average transit Time (days)	Cumulative Time(days)	Average Cost ($)	Cumulative Cost($)
Busan		0	0	0	0
Busan-B. Abbas	Sea	22.5	22.5	1600	1600
B. Abbas		7	32	100	1700
B. Abbas-Tashkent	Road	9	38.5	3500	4200

3) Summary

Uzbekistan is one of the landlocked countries so that in order to be connected with seaports, the major ports on the Pacific, Black Sea, Baltic Sea, Persian Gulf, and Mediterranean Sea can be selected according to origins and final destinations of cargos. By using one of the ports on coastal areas mentioned above, road and rail are the principal modes of transport to access to inland cities. In particular, road transportation is commonly used for connecting Western Europe, Turkey, and Russia Federation. On the other hand, in the case of cargos from Pacific region, the use of rail transport has been growing using TSR or TCR routes. And

forwarders in Uzbekistan have been exploring the development of other routes which are the new rail connections to China via Afghanistan and to Karachi Port in Iran.

On route branches off from the Trans-Siberian Railway (TSR) at Novosibirsk, running south to Kazakhstan and Uzbekistan. Block trains run from Vostochny Port to Alamty. This rout's competitor is the Trans-China Railway(TCR). Container is carried on China's railways from Chinese ports such as Lianyungang, Qingdao, and Shanghai to Alashankou before crossing the western border and reaching Kazakhstan and Uzbekistan via Dostyk(Druzhba).

Apparently, there exist the competitiveness between the TSR and TCR, and both routes have their advantages and disadvantages with respect to seasonality and the final destinations of cargos. Due to difference in the type of goods to be transported, it is difficult to compare the costs and time of both routes. However, in overall terms, TCR is getting a popular route since one of Korean forwarders reported that owing to the convey charge on the TSR, the flow of cargos shifted to the TCR. Furthermore, block trains have begun to run from Tianjin, Qingdao on the TCR in order to reduce the transport time, which previously originated at Lianyungang Port. In addition, the number of sailings from Japanese and Korean ports to Vostochny Port is less than to Chinese ports so that TCR is said to be more convenient.

As a result, for landlocked countries like Uzbekistan, transit transport at border crossings is one of the most constrained parts by delays and costs. These countries have traditionally developed bilateral transit agreements with neighboring nations to overcome geographical constraints. But they could be affected by political and economic changes. Thus, these issues should be considered when designing the ITPM.

Chapter 4

CONCLUSIONS

Today, intermodal transport systems and their connections to the inland cities play a crucial role in the economic development of each country. An efficient logistics network system for door-to-door service should facilitate international and bilateral trade. For developed countries, they have enough finance and technologies to analyze their whole transport and logistics systems for improving efficiency of the systems. But developing nations do not have this ability owing to many kinds of limitations in money, resources, and etc.

The MPPM developed by UN ESCAP has helped the countries in the ESCAP region for the area of investment in a container ship and a container terminal since these require a large amount of capital. This MPPM is basically focused on a planning context for port-to-port operations. In recent years, intermodal transport systems and their connections to the inland cities play a crucial role in the economic development of the regions of the country. An efficient logistics network system for door-to-door services should facilitate international and bilateral trade. With respect to integrated logistics services in supply chain management, the ITPM is thus highly desirable. In this regard, KMI conducted the study as an international cooperation with UN ESCAP. The aim of this study was to provide the basic information for designing the ITPM that can handle not only maritime

transportation but also inland transportation in the ESCAP region. Consequently, ITPM model can support the analysis of overall transportation system of the ESCAP region, possibly linking Trans Asian Railroad and Trans Asian Highway. In this study, three countries, South Korea, China, are Uzbekistan, were chosen and investigated with respect to the cargo flows. In case of China, nine provinces along the Yangtze River were considered.

Some of findings from the case studies can be summarized as the following manners. But the reliability of the data used should be taken into account since various companies and organizations provided them in terms of their own situations. It points out that this in not absolute values. Initially road transport may be cheaper than rail or river transport over shorter distance because the initial costs or time are required to move the products to the railway stations or river ports. Like Korea, road transport is dominant mode of cargo transportation since most of cargos could be delivered within about 8 hours by trucks. This indicates that a small country that has its own seaports might not be needed to describe the detail inland network within the ITPM In this way, the complexity of model could be reduced. On the other hand, a big country like the China could have a number of various routes to be explored with combination of different transport modes. As the distance increases, river transport has a lower per kilometer cost than rail. At the same manner, railway has a lower transport cost than road. It means that the previous MPPM has to extend the optimization modeling module embodied in the Liner Shipping Network Model.

For landlocked countries like Uzbekistan, transit transport at border crossings is one of the most constrained parts by delays and costs. These countries have traditionally developed bilateral transit agreements with

neighboring nations to overcome geographical constraints. But they could be affected by political and economic changes. In addition to costs and time factors, these countries are thus also facing the issue of reliability of the route where reliability can be explained in terms of consistent transit time, predictability of costs, damage of journey, and overall security concerns. Consequently, a module that takes into account such reliability issue could be required to analyze the intermodal network in landlocked countries. At the same time, China as a developing country also has to consider the issue of reliability since this country does not have enough transportation infrastructures. For example, rail transportation in China.

The Korea government is currently promoting projects linking the Trans-Korean Railways (TKR) to the Trans-Siberian Railway (TSR) and eventually connecting TKR to the TAR and European Railways. At the same time, China, Russia and Mongolia are actively pursuing connection of their railways to TKR. In the near future, this new corridor can make big changes into a transportation network in the Eurasia continent since transportation cost and transit time to Europe can be saved. Eventually this will serve as the land bridge, promoting economic union of Asia and Europe. In this regard, UN ESCAP is pushing forward construction of the northern route of the TAR.

As a result, the ITPM for the inland transport and logistics system should integrate inland transportation infrastructure, logistics components, and data with following composition:

a) Infrastructure
   - The main port clusters linked with inland cities in the ESCAP region
   - Intermodal land transport routes comprising priority of road, river, or rail

- Major container terminals
- Logistics facilities

b) Logistics components

- Identify major provincial cities/economic centers, major railway stations with container yards, inland water terminals, container terminals, and airports.
- Simulation or optimization modeling techniques are needed to help strategic decisions
- Reliability factor could be incorporated into inland transportation model especially in the ESCAP region since the area usually has poor transportation infrastructure and multi-national transit environment

c) Data

- Costs data could be one of the most difficult task to get since these are not usually publicly available
- The origin and inland destination of cargo
- Distance for each transportation leg
- Transit time for each transportation leg (in hours or days)

Finally, it is hoped that the contents of the study will contribute a better understanding of transport issues for the three countries and thus assist in formulating effective policies to enhance their intermodal transport systems and processes.

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