

## **Analysis of the Logistics Patterns of Korea's Free Economic Zones in Northeast Asia and the Implications<sup>+</sup>**

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### **Abstract**

*This paper analyzes the logistics patterns of Korea to elaborate the strategies of Korean Free Economic Zones (FEZs) in relation to Northeast Asian logistics hubs. As the surface transportation of Korea, China and Japan, is cut off by geographical factors and by political border lines, this paper confines the analysis scope to air and maritime transportation.*

*From the analysis of air and maritime transportation in Northeast Asian region, this paper tries to understand the cargo flow from and to Korean airports and ports by region and by commodity types, and thereby, to identify the main counterpart regions of trade by commodity types and by modes. The policy implications for the development strategy of Korean FEZs (Incheon, Busan, and Gwangyang) are described from those analyses.*

**Key Words:** Logistics Pattern, Free Economic Zone, Northeast Asia

### **I . Introduction**

This paper is to present a concrete analysis of the logistics patterns of Korea among Northeast Asian countries. As the surface transportation of the three countries such as Korea, China and Japan, is cut off by the geographical factors and by political border lines, this paper confines the analysis scope to air and maritime transportation.

From the analysis of air and maritime transportation, this paper tries to understand the cargo flow from and to Korean airports and ports by region and by commodity types, and thereby, to identify the main counterpart regions of trade by commodity types and by modes. These will, we expect, be led to draw policy implications for the development

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strategy of Korean FEZ's (Incheon, Busan, and Gwangyang).

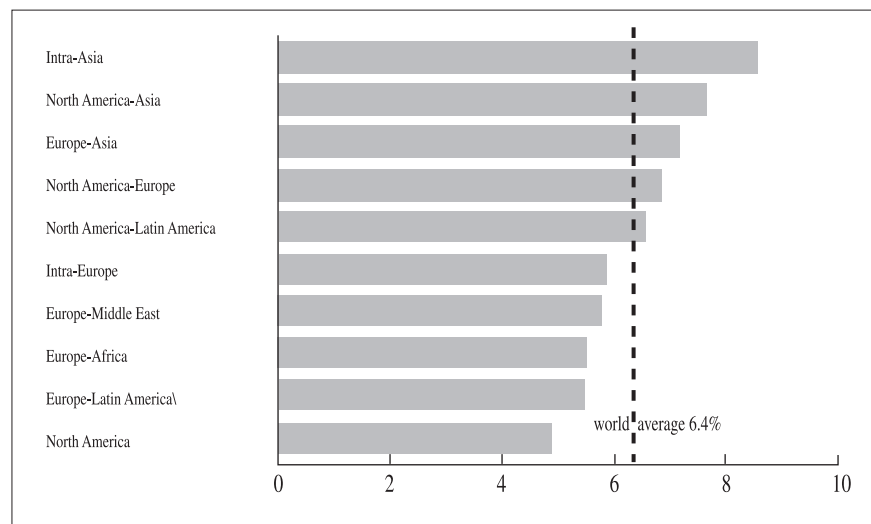
This paper consists of two major parts. The first half is filled with the analysis of the air transport logistics patterns of air transport. In particular, the cargo transport routes between Korea and China are analyzed precisely and the sea and air cargo pattern is examined to determine new possibilities for the logistics patterns between the two countries. The second half deals with the maritime logistics pattern. In this part, the role of Busan Port as the hub of Northeast Asian maritime transport is investigated. Cargo transport between China and Korea, western Japan and Busan is the main scope of the analysis. The pattern of transshipment is analyzed as a complementary index for maritime transport hubs.

## II . Logistics Patterns of Air Cargo

### 2.1. Global Trend

Worldwide air cargo has been growing 6.4% annually for the last ten years. The air cargo of Asia-related routes has been increasing faster. The growth rate of intra-Asia routes, which is above eight percent, is at the top of the list, though those of North America-Asia and of Europe-Asia routes are all above the world average growth rate. As a result, the market share of Asia -related air cargo is 48.6%, which is bigger than that of North America-related routes (38.9%), though still smaller than that of Europe-related routes (53.2%).

**Figure 1.** The Growth Rate of World Air Cargo

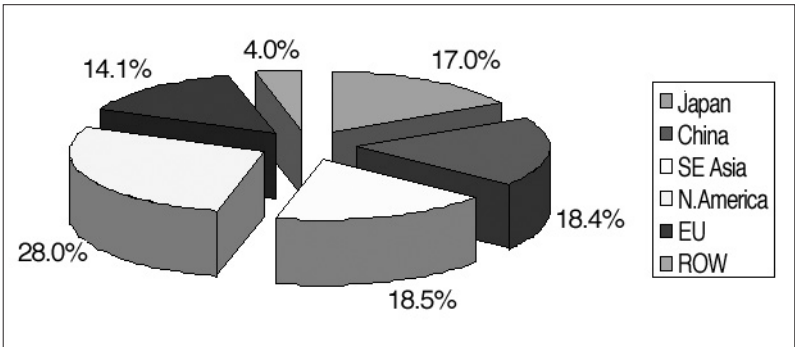


Source : IATA(2001), "Aircargo Annual," (4<sup>th</sup> Ed.).

2.2. Korean International Air Cargo Market

Incheon International Airport, which is opened in 2001 to take the place of the Gimpo International Airport, recorded 127 thousand flights, 19.5 million passengers transport, and 2.1 million tons of cargo in 2003. In the cargo market, Korea-North America routes are the biggest market, and Korea-China routes are the fastest growing market.

Figure 2. Cargo Transport by Region

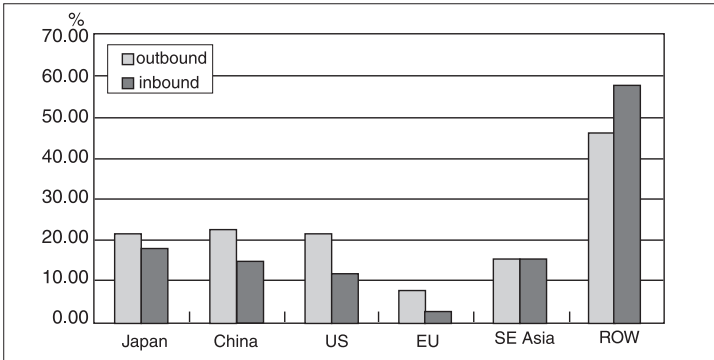


Source : MOCT(2004).

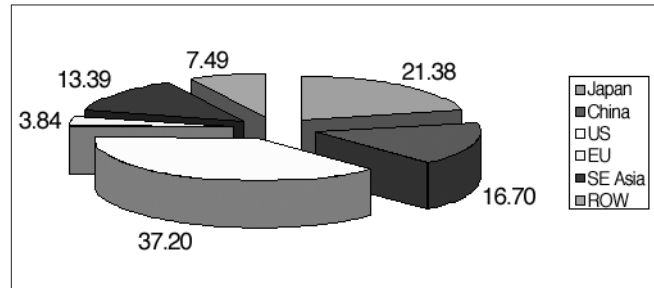
The rate of cargo transshipment (T/S) in relative to total cargo treatment at Incheon International Airport is 42.6% in 2003. Out of that, the T/S rate without the changing of planes is 18.5%. Analyzing the T/S pattern by regions, the T/S rate related with Europe is relatively low. It is because the routes to the EU from the Incheon International Airport are not diversified yet due to the lack of bilateral agreements between Korea and the countries in the EU.

Over 35% of outbound T/S from Incheon is destined to the US, and the similar portions are destined to China and Japan. Inbound T/S to Incheon is originates mainly from Japan, the US, and Southeast Asia. The relative importance of China is not so big yet, though its weight is growing rapidly.

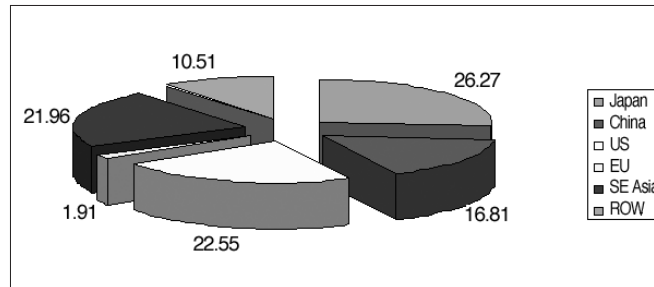
Figure 3. Rate of Transshipment by Region



Source : MOCT(2004).

**Figure 4.** Share of Outbound Cargo Transshipment

Source: MOCT(2004).

**Figure 5.** Share of Inbound Cargo Transshipment

Source: MOCT(2004).

### 2.3 .China-Korea Air Cargo Market

The China-Korea route covers 23 Chinese cities and eight Korean cities through 465 flights per week, including 32 cargo-only flights. Major counter origin and destination airports for air cargo transport with Incheon in China include Shanghai, Hong Kong, Beijing, Qingdao and Guangzhou.

However, most cargo-only flights are to or from Hong Kong (24), followed by Shanghai (4). T/S cargo is mainly from or to Hong Kong, Shanghai, and Beijing. The T/S share with Beijing is relatively high compared with its absolute volume, because other airports are busy treating direct flights.

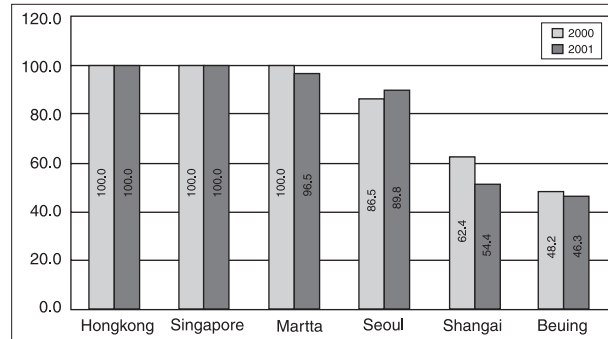
**Table 1.** China-Korea Air Cargo Routes

NO	Destination (China)	Origins(s) (Korea)	Freights /week		Airlines	Capacity (ton)
			Passenger			
1	BEIJING	INCHEON, GIMHAE, JEJU	50	1	KAL, AAR, CCA	600
2	CHANGCHUN	INCHEON	12	0	AAR, CSN	120
3	CHENGDU	INCHEON	5	0	AAR, CCA	50
4	CHONGQING	INCHEON	4	0	AAR, CCA	40
5	DALIAN	INCHEON	7	0	CSN	70
6	GUANGZHO	INCHEON, DAEGU	25	0	AAR, CSN	250
7	GUILIN	INCHEON	3	0	AAR	30
8	HANGZHOU	INCHEON	12	0	AAR, CCA	120
9	HAERBIN	INCHEON	8	0	AAR, CSN	80
10	HONGKONG	INCHEON, GIMHAE	70	24	KAL, AAR, PO, etc.	3,100
11	JINAN	INCHEON	4	0	KAL, CES	40
12	KUNMING	INCHEON	4	0	KAL, CES	40
13	NANJING	INCHEON	6	1	AAR, CES	160
14	QINGDAO	INCHEON, GIMHAE, DAEGU	38	0	KAL, CCA	380
15	SHANGHAI	INCHEON, GWANGJU, GIMHAE, YANGYANG, JEJU, CHEONGJU, DAEGU	104	4	CES, AAR, KAL, GE	1,440
16	SHENYANG	INCHEON, GIMHAE, CHEONGJU, DAEGU	19	0	KAL, CSN	190
17	SHENZHEN	INCHEON	0	1	AAR	100
18	TIANJIN	INCHEON	10	0	KAL	200
19	WUHAN	INCHEON	2	0	KAL	20
20	XIAMEN	INCHEON	5	0	KAL, MF	50
21	XIAN	INCHEON, GIMHAE	7	0	AAR, CES, KAL	70
22	YANJI	INCHEON	8	0	KAL, AAR, CSN, etc.	80
23	YANTAI	INCHEON	30	0	AAR, CES	300
total			433	31	12	7,530

Source : KITA(2004).

The biggest capacity of for air cargo treatment among Chinese airports is at Hong Kong (3,100ton/week), followed by Shanghai and Beijing.

The share of international cargo relative to total cargo in Chinese airports is still not high, with the exception of Hong Kong. While the rates of international air cargo in major airports are over 90%, the rates in Chinese airports are still half the cargo handled.

**Figure 6.** Share of International Cargo Traffic at Major Asian Airports

Source : IIA(2003).

Major commodities of air cargo in China are electronic equipment, apparels and precision instruments, which are similar to primary air cargo commodities in other countries.

**Table 2.** Major Commodities of Air Cargo in China

Commodity	Value(\$MM)
1. Electronic Components, NEC	1,561
2. Semiconductors/Related Devices	594
3. Computer Peripheral Equipment	576
4. Computer Storage Devices	474
5. Women's/Misses Blouses/Shirts	466
6. Household Audio/Video Equipment	431
7. Girls'/Children's Outerware, NEC	366
8. Telephone/Telegraph Apparatus	304
9. Photographic Equipment/Supplies	274
10. Dolls and Stuffed Toys	222
Other	5,237
Total	10,506

Source : Yu, C.(2002).

Only 15% of international cargo at Beijing is to or from Korean airports. By airlines along the Korea-Beijing route, Korean Air has the largest market share (37%), followed by Air China (34%), and Asiana (27%). In the case of Shanghai, only eight percent of international cargo is to or from Korean airports, and 43% of the market share is held by China Eastern(43%), followed by Asiana (37%), and Korean Air(19%).

In the Chinese air cargo market, the share to or from Korean airports - including Incheon - is relatively small. This is partly due the fact that the share of international air

cargo is still low in Chinese airports as indicated above. However, even considering this, the importance of the Korean air cargo market for China is relatively low.

**2.4. Sea and Air Cargo Pattern**

The concept of sea and air transport between China and Korea and Japan is as follows:



This kind of logistics pattern has been developed due to the inconvenience of the surface transport network in western China and the shortage of capacity and network in Beijing Airport. The transport time from Qingdao Port to Beijing by rail is about ten hours, which is not competitive with the transport time from Qingdao to Incheon Port, which takes 13 hours. Another problem is that, due to the lack of network in Beijing Airport, the cargo has to wait about 15 hours at the airport terminal until it loads, while the waiting time of cargo in Incheon Airport is only 3 to 4 hours.

Consequently, total time from Qingdao to New York in both route, for example, is about 40 hours in either case, while the total cost of transportation in by sea and air (Qingdao-Incheon-New York) is 85% of that by land and air (Qingdao-Beijing-New York). This is the reason why the sea and air concept has been developed as a more effective transport route.

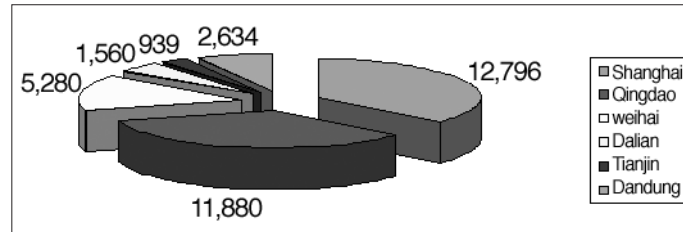
Until 2002, high-valued light products such as apparel, shoes, jewelry, were the main items shipped through this pattern, but, from 2003, the volume of high-edged electronic products has been increasing.

**Table 3.** Trend of Sea & and Air Transportation Across the Yellow Sea

	1999	2000	2001	2002	2003
Times	21,079	20,019(-5.0)	16,931(-15.4)	21,990(29.9)	31,769(44.4)
Volume(ton)	20,483	18,782(-8.3)	16,760(-10.8)	24,977(49.0)	35,965(44.0)

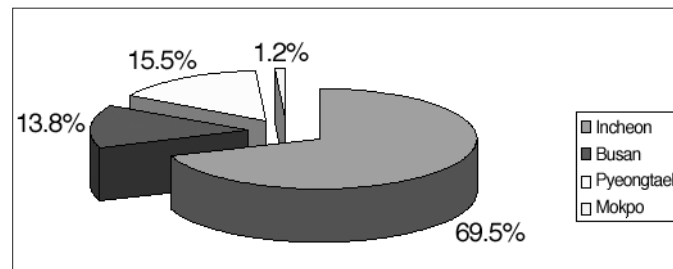
Source : IIA, Internal Report, each year.

Until 2002, the main origin of sea and air transportation was Qingdao, but from 2003 the volume from Shanghai has been growing faster (the average growth rate is 44.5%). This is partly due to the SARS outbreak in China, after which the air service between Shanghai and North America had been reduced. However, the main trend is that the combine sea and air routes are being diversified.

**Figure 7.** Origins of Combined Sea & and Air Routes

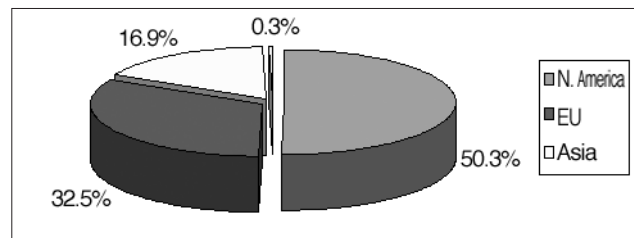
Source : IIA, Internal Report, each year.

Korea's west coast ports such as Incheon and Pyeongtaek are main stopping-over points for combined sea and air transportation routes because they are along the shortest path to Incheon Airport from China. At Incheon Port, the annual growth rate of combined sea and air cargo 75%. One peculiar point is that the portion of combined sea and air cargo from China that stops over in Busan, which is far from Incheon, is still significant. The reasons are that the feeder routes in the Yellow Sea to Japan are concentrated on Busan and that the air flight routes via Narita are often available.

**Figure 8.** Stopping - Over Points of Combined Sea &and Air Routes

Source : IIA, Internal Report, each year.

Main destination points of sea and air cargo are North America and the EU. In detail, cargo to France and the U.K has increased over two times, accelerated by the increase in the value of the Euro. However the lack of a developed air network between Incheon and the EU is one of the major obstacles for further development.

**Figure 9.** Destinations of Combined Sea & and Air Transport

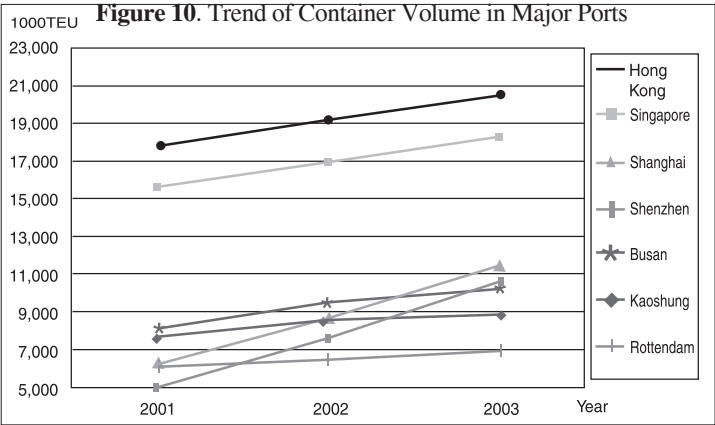
Source : IIA, Internal Report, each year.



III . Logistics Patterns of Maritime Cargo

3.1. Overall Trends

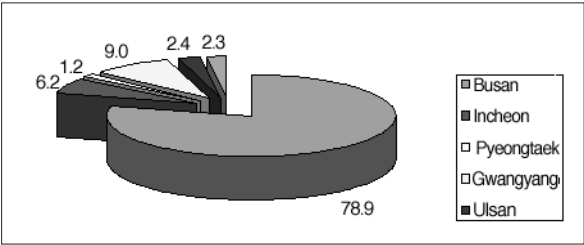
In 2003, Busan dropped to fifth in the world in container throughput, overtaken by Shanghai and Shenzhen. This trend is anticipated to continue and, in near future, other ports in China such as Qingdao and Tianjin may over take Busan. Considering the economic growth of China, it should be accepted to be a natural consequence.



Source : MOMAF(2004), Internal Report.

Of 13 Million TEU in 2003, Busan and Gwangyang account for 88% of the total container throughputs in Korea. Ports on the west coast of Korea, Pyeongtaek and Gunsan, are growing rapidly, but still insignificant in volume. Another point to review is that the growth of Gwangyang is stagnated contrary to original the expectations.

Figure 11. Share of Container Trend



Source : MOMAF(2004), Internal Report.

In 2003, the growth rate of container throughput of Busan Port was 8.9%, which is slightly less than the total cargo growth rate of 10.5%.

The main counter part of trade with Busan Port is still China (30.4%), followed by North. America (21.5%), Japan (15.2%), Southeast Asia (9.0%), and the EU (8.9%). The share of trade with China, and Southeast Asia has slightly decreased recently, whereas the share with Japan and North America has increased. The reason for this trend can be explained by the rapid growth of Shanghai and Shenzhen, though it is too early to jump to a conclusion.

In 2003, the growth rate of container throughput at Gwangyang Port was 9.6%, which is also slightly less than the total growth rate.

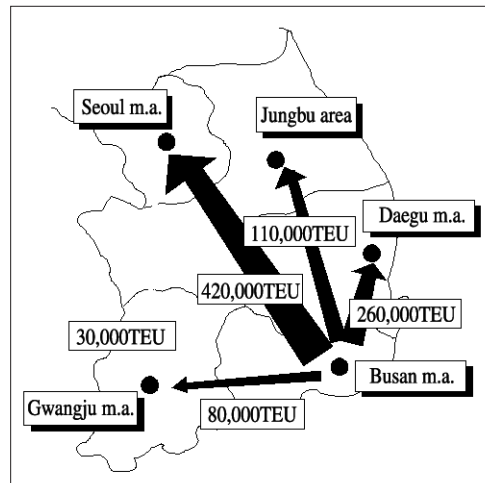
The main counter part of trade with Gwangyang Port is also still China (52.9%) and the share of trade with China is increasing rapidly, whereas the share of trade with other countries is decreasing or stagnant. It might mean that Gwangyang's role as a hub port is hardened as a subsidiary of Busan or major Chinese ports, which can be an obstacle of future growth to the port, especially when the infrastructure of Chinese ports is expanding rapidly.

### 3.2. Domestic Container Movement

As of 2001, imported containers are mainly transported to the Seoul metropolitan area (47.4%), of which, those via Busan are over 90%, but those via Incheon or Pyeongtaek are increasing rapidly.

The role of Gwangyang is not significant yet. The rest of the containers are destined for places scattered around the nation, mainly to the Daegu metropolitan area.

**Figure 12.** Imported Container Movement



Note : 1. Intra-regional and below-ten-thousand TEU containers are not included

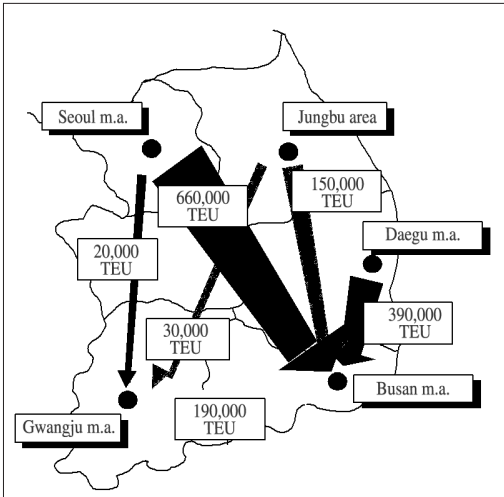
2. m.a. means metropolitan area

Source : KOTI(2004).

The origins for containers exported from Korea are similar to the destinations of those imported. The Capital area is the origin of 46.4% of exported containers and another 26.8% come from the Daegu metropolitan area.

A major portion of exported containers from the Gwangju metropolitan area is directed to Busan, which means that the role of Gwangyang is not significant for Korean exports either.

Figure 13. Exported Container Movement



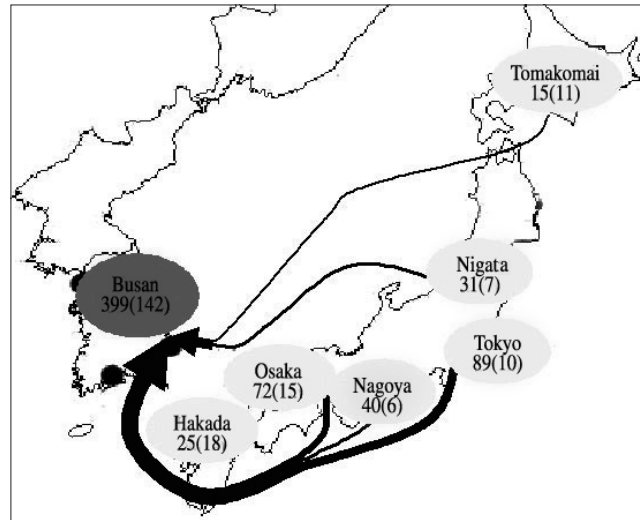
Note: 1. Intra-regional and below-ten-thousand TEU containers are not included  
2. m.a. means metropolitan area

Source : KOTI(2004).

### 3.3. International Logistic Patterns of Cargo at Busan Port

#### Japan to Busan

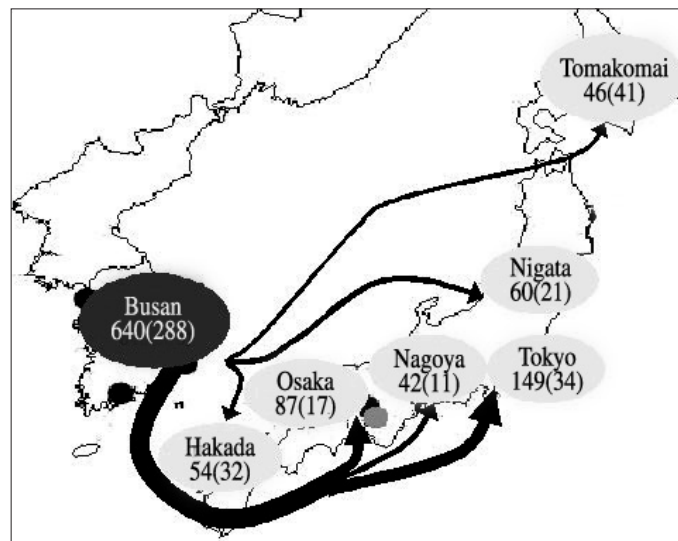
Maritime cargo from Japan originates mainly from Tokyo and Osaka. T/S cargo accounts for 35% of maritime cargo from Japan, which is mainly from Hakada and Osaka. The growth rate of cargo from Tomakomai has been very rapid, which implies that Tomakomai is being developed as another major port on the trunk line in Asia-Pacific trunk line.

**Figure 14.** Japan to—> Busan Container Movement (1000TEU, Total (T/S in ( )))

Source: Korea Maritime University(2002).

### *Busan to Japan*

Maritime cargo to Japan is destined mainly to Tokyo and Osaka, similar to the case of cargo from Japan to Busan. T/S cargo accounts for 45% of maritime cargo to Japan, which is mainly to Tomakomai, Tokyo, and Hakata. The growth rate of trade with western ports in Japan is very high in recent years.

**Figure 15.** Busan to—> Japan Container Movement (1000TEU, Total (T/S in ( )))

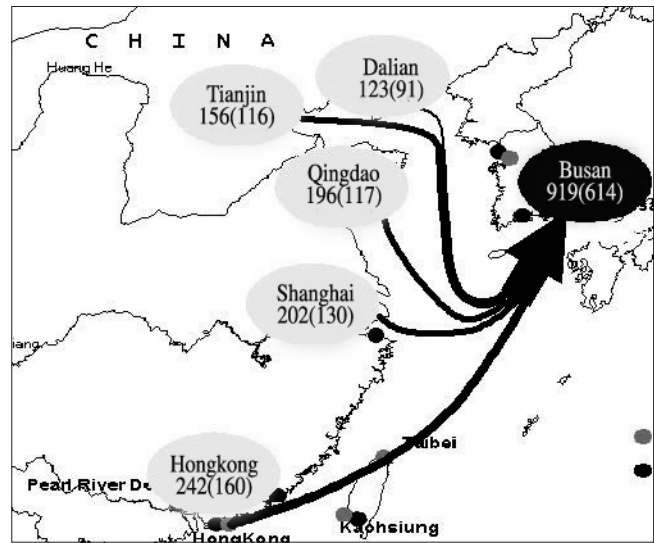
Source: Korea Maritime University(2002).

*China to Busan*

Maritime cargo from China is originated/originates mainly from Hong Kong, Shanghai and Qingdao. Of the maritime cargo from China, 66% is T/S (more than to and from Japan), which is mainly from Hong Kong and Shanghai.

The T/S rate is above the average T/S rate of Busan Port, which means that Busan Port is functioning as the logistics hub of Chinese exported cargo.

**Figure 16.** China —>to Busan Container Movement (1000TEU, Total (T/S in ( )))

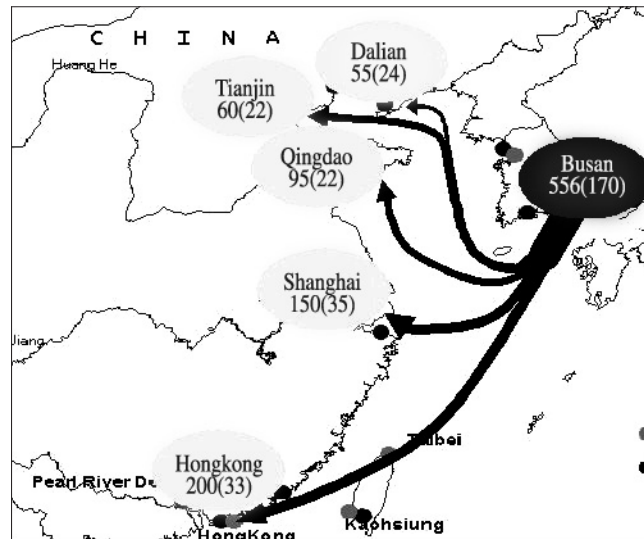


Source: Korea Maritime University(2002).

*Busan to China*

Maritime cargo to China is destined mainly to Hong Kong and Shanghai. T/S cargo accounts for 31% of maritime cargo to China, which is mainly to Hong Kong and Shanghai.

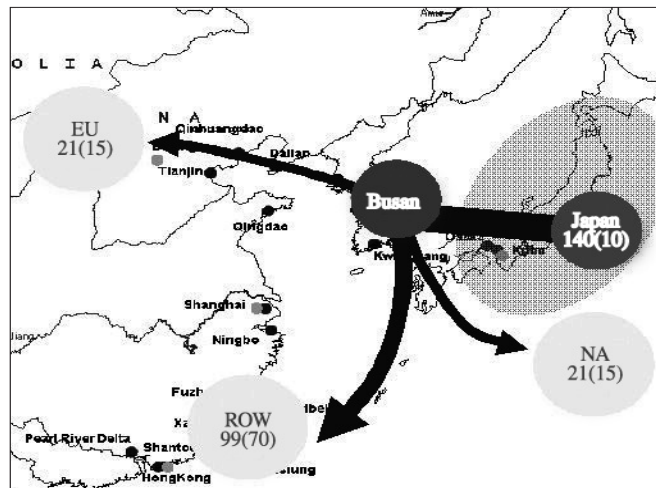
The main reason for the difference of the T/S cargo rate between inbound and outbound shipments is that the cargo to China, especially from the EU, uses direct shipping by picking up cargo at the production points.

**Figure 17.** Busan → to China Container Movement (1000TEU, Total (T/S in ( )))

Source: Korea Maritime University(2002).

#### *T/S Cargo : Japan to Busan to the World*

Among T/S cargo from Japan, 15% is destined to the EU and another 15% to North America, and the remaining 70% is destined to the rest of the world. The low percentages to North America and the EU are because the cargo to the EU or North America from Japan is directly shipped in the ports of Japan. This means that Japan uses Busan Port as a complementary port of their major ports.

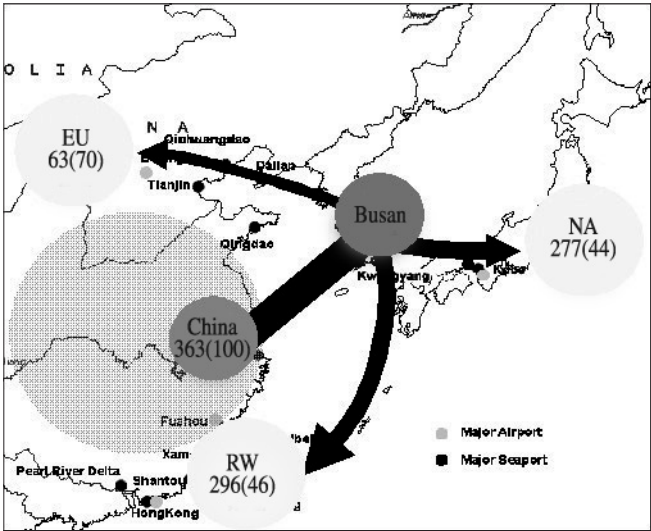
**Figure 18.** Japan to → Busan to the → World (100 TEU, % in ( ))

Source:: Korea Maritime University(2002).

*T/S Cargo : China to Busan to the World*

Among T/S cargo from China (about five times of that from Japan), 44% is destined to North America and ten percent to the EU. This difference has its root in the geographic location of Busan. As Busan is located farther east and closer to North America, the cargo to North America uses Busan as a logistics hub. But, in the case of the EU, Hong Kong is a closer and more viable alternative to Busan.

**Figure 19.** China to —>Busan to —>World (100 TEU, % in ( ))



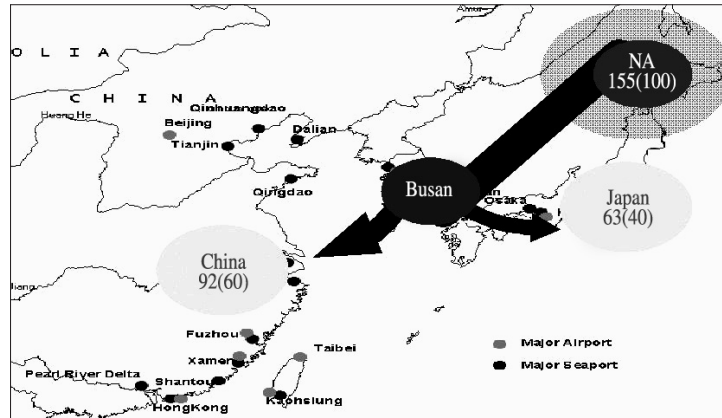
Source: Korea Maritime University(2002).

*T/S Cargo : The World to Busan to China and, Japan*

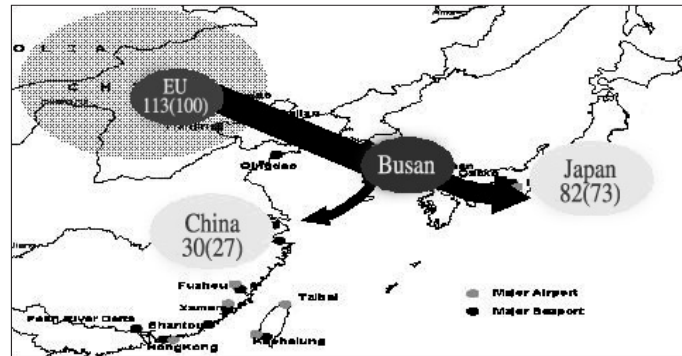
Among T/S cargo from North America, 60% is destined to China and the rest of it to Japan, while 73% of T/S cargo from the EU is destined to Japan and rest of it to China. This difference can be explained by the geographic location of Busan, too. The T/S cargo from the EU to China does not necessarily stop at Busan, because it can be transshipped in Hong Kong.

Among T/S cargo from the rest of the world, 70% is destined to Japan and the rest to China. This can be due to the same reason as with the case of the EU. Most of the cargo in the rest of the world is from Southeast Asia, and the cargo need not stop by Busan in order to go to China.

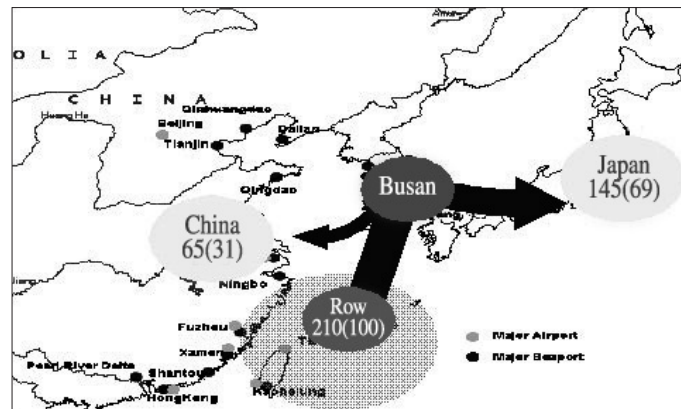
From these statistics about the current T/S demand at Busan relative to other nations, we can conclude that Busan, or Gwangyang, should seek to be the Northeast Asian logistics hub for cargo from and to North America.

**Figure 20.** North America to → Busan to → China and, Japan (100TEU, % in ( ))

Source: Korea Maritime University(2002).

**Figure 21.** EU to → Busan to → China and, Japan (100TEU, % in ( ))

Source: Korea Maritime University(2002).

**Figure 22.** ROW to → Busan to → China and, Japan (100TEU, % in ( ))

Source: Korea Maritime University(2002).



#### **IV. Conclusion : Policy Implications**

From the analyses above, we can propose several policy alternatives.

First, Incheon International Airport, as the air hub of the Incheon Free Economic Zone, is still a minor counterpart to Shanghai and Beijing. Hence more effort to extend the market share into Chinese air transport is necessary.

Second, investment in Incheon Port and Pyeongtaek Port should be expanded especially to promote Korea-China trade across the Yellow Sea, including combined "sea and air cargo transport". But a more concrete strategy for the western ports should be elaborated, especially concerning the division of roles between "Busan and Gwangyang".

Third, the role of Gwangyang Port is ambiguous at present. It is due to the duplication of roles with Busan Port. Hence, more careful consideration on the role of the port should be sought.

Finally, as for the Busan Port, as the hub of Northeast Asian maritime hub, more proactive relations with the west coast of Japan should be promoted.

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