INCREASING THE EFFICIENCY OF THE AIR CARGO INDUSTRY IN KOREA

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Abstract: Asia is one of the fastest growing regions within the global air transport market. Since the 1990s, air cargo volumes in the region have increased dramatically. In response to such trends, many Asian countries have opened new airports or expanded existing air cargo facilities to accommodate more cargo and to be developed as a regional air logistics hub. Although air cargo accounts for only 0.3% by weight of all cargo traded by Korea, its value share was much higher at more than 30%. The interests in developing Korea's air cargo industry arise due to the fast growth of the sector, and to the push by shippers and traders, and freight carriers. This paper presents an analysis of the development of air cargo industry in Korea. The characteristics and trends of air cargo industry in Korea and Northeast Asia are assessed. To identify current situation and facing problems of air cargo industry, several factors such as geographical location, costs, infrastructures, customs, and air transport policies are reviewed. The analysis includes various role players such as shippers, forwarders, airlines, customs office, airport authorities, and government. Some other issues included in this paper are air cargo information system for efficient air cargo business, sea-&-air transport, and express cargo transport, etc. Finally, this study suggests some policy implications for the development of air cargo industry in the region for the 21st century.

Key words: air cargo, efficiency

1. INTRODUCTION

As the activities of many companies become increasingly global and just-in-time concepts are becoming more universal, the amount of goods carried by air is increasing continuously. Statistics show that air cargo traffic has been growing faster than passenger traffic in most regions of the world for several decades. Air freight is playing an ever-increasing role in the distribution systems of many companies, which have recognized that the higher line-haul costs of air service can be offset by lower inventory, warehousing, and packaging costs (Ye,

2000).

However, historically, discussion of air transport has been dominated by passenger concerns, rather than air freight issues, in part because air freight has often been considered a by-product of air passenger services (Murphy, et. al., 1989). Some work has been undertaken on express air cargo transport, including the cost structures of the integrated carriers (Kiesling et al., 1993), spatial patterns and network design problems (Chestler, 1985; Kuby et al., 1993; Hall, 1989), and pickup and delivery systems (Hall, 1996; Kim, 1997). Few studies have examined the cargo component of the combination air carriers. For example, DeLorme et al. (1992) have devised a simulation model of a combination carrier's operations at a hub airport; the problem of scheduling transshipment operations problem for KLM has been examined by Verwijmeren, et al. (1993); and Kasilingam (1996) has compared air cargo revenue management and passenger yield management. It is far more difficult to see studies on the cargo industry in a region except Hong Kong's case (Waiman Cheung, et. Al., 2002).

The government of Korea is driving a national strategy for developing a regional logistics hub in the Northeast Asia and air cargo plays ever-increasing roles in international logistics. But little attention has been paid to the air cargo industry even after the opening of Incheon International Airport. This study aims to evaluate current situation of the air cargo industry in Korea and to consider a sound development direction by assessing the characteristics and trends of air cargo in Korea, and by finding institutional and operational obstacles that hinder development of air cargo transportation. Its findings are based on interviews and discussions with users such as shippers, forwarders, and airlines, and supporting institutions such as airport authorities, customs offices etc.

As the major target areas for increasing efficiency, this study covers issues on air cargo transportation industry including shippers, forwarders, airlines, sea & air transportation, and international express services, and issues on infrastructure facilities and transportation system. For infrastructure issues at airports, air cargo terminals and warehouses at Incheon International Airport and Gimpo International Airport are considered. Other issues include the alteration of air cargo transportation process after the opening of Incheon International Airport, air cargo information system, and customs process, etc.

2. CHANGES IN AIR CARGO MARKET AND OUTLOOK

The business environment is changing rapidly. Globalization, mass individualization focusing core business are the main drivers for changing logistics concepts. In mass individualization, companies combine standardized process components within a network in order to fulfill the needs of a customer. In mass customization they combine standardized product components to create a more or less tailor-made product. The concept of regional distribution centers is emerging to meet various customers' needs in time. For the reason, global logistics companies are enlarging their capabilities for providing comprehensive value added logistics services. As

shown in the cases of global networks mainly created by big forwarders, air cargo market seems to be expanded by broad strategic alliances among air carriers.
The development of digital technology and Internet will cause great changes in all industries, and air cargo transportation industry will not be an exception. As traditional practices of trade is expected to be changed essentially by information technology, discussions on paperless trade and global e-business will be spread as an important agenda in WTO and APEC.

2.1 **Strategic Alliances in Air Cargo Market**

Based on their global networks, airlines are increasing cooperation in cargo transportation through common service options, sales, service standards, and compatible information systems. Aeromexico, Air France, Delta Air, Korean Air has launched the first air cargo alliance-SkyTeam Cargo in September 2000. SkyTeam Cargo has extended its reach with the joining of Czech Airlines in April 2001 and Alitalia in August 2001. SkyTeam Cargo customers now have access to a combined fleet of 1,224 aircraft, making 8,217 daily flights through alliance's extensive network. With the addition of Czech Airlines Cargo and Alitalia Cargo, SkyTeam Cargo has grown from 411 to 512 unduplicated destinations, 100 to 114 countries served, 14.0 billion to 15.1 billion freight ton kilometers carried per year.
Another air cargo alliance-WOW Cargo Alliance has started in October 2001 by Lufthansa, Singapore Airlines, SAS. Japanese Airlines has joined in WOW in July 2002. WOW offers a combined network of over 500 destinations in 103 countries. And with over 3,660 daily flights on 810 aircraft, WOW is shrinking the world and powering world trade.

2.2 Information Technology

Whereas computerized reservation system is an excellent example of information technology applied to air passenger transportation, computerization of air cargo transportation requires much more exchanges of documents and information. It is because cargo transportation needs to process not only simple airwaybill but also various documentation and information for customs clearance and security check, etc. Although EDI processing by VAN is commonly used in many countries, its applications are still restrictive. Cargo community systems, which connect airlines and forwarders, need to be developed to meet needs for cargo tracing, to provide detailed information to forwarders, and to compete with integrators providing location information of cargo from consignor to consignee in real time.

2.3 Emerging Integrators

As the concept of air cargo transportation is changing from port-to-port to door-to-door, equipped with delicate cargo tracing system of door-to-door level, integrators are growing

rapid and expanding business into trucking by the explosion of express cargo demands. Integrators are threatening conventional airlines and forwarders by penetrating into general air cargo market while utilizing their global networks.

This trend means that dividing air cargo markets as general air cargo and express cargo is becoming less important and airlines need to set a new paradigm. Consequently, to optimize time and cost in transporting air cargo and to survive form this fierce competition, carriers need to develop worldwide total logistics services.

Another noticeable issue in international express cargo market is the opening of mail transport business. In 1998, as the Universal Postal Union agreed to abandon governments' exclusive rights of international mail service after 2003, it is expected that governments' postal agencies will merge or cooperate with private carriers to cope with changing market environment.

The international express market continues to grow at an extraordinary pace. Growth for this segment of the industry is estimated to have grown at an average rate of 20.9% per year since 1991. International express traffic expanded from 3.7% of total international air cargo traffic in 1991 to 11.8% in 2001 and showed growth of 7.9% in 2001 and 17.9% in 2000 (Boeing, 2002).

2.4 Air Cargo Transportation in the Northeast Asian Region

It is expected that, after the joining WTO, the economic growth of China will lead the Northeast Asian region's market and will induce the rapid growth of air cargo transportation in the region. As neighboring countries expect increasing chances for investing and exporting which will cause huge growth of air cargo transportation, intensive competition will be deployed among airlines and airports in the region to attract air cargo.

Considering the fact that Korean, Japan, and Taiwanese companies who manufacture semiconductors, computers, and electric products have shifted their high-tech manufacturing bases to other Asian countries including China, air cargo transportation will play more increasing role.

According to Boeing Company forecast, world air cargo will grow at 6.4% per year during the next 20 years, and world air cargo traffic will be more than triple over the next 20 years, increasing from 131.1 billion RTKs in 2001 to over 464 billion RTKs in 2021. Domestic China will be the fastest growing contiguous market in the world, averaging 10.3% growth per year for the forecast period. Air cargo traffic growth in international trade lanes linked to Asia will lead all other international geographic markets in average annual growth for the period 2001 to 2021. Intra-Asia will grow the fastest of Asian markets, averaging 8.4% growth per year, while the Asia-North America and Europe-Asia markets will expand at average annual rates of 7.5% and 7.0%, respectively (Boeing company, 2002).

3. DEVELOPMENT OF AIR CARGO TRANSPORTATION IN KOREA

3.1 Air Cargo Industry in Korea

The key markets for Korea air cargo are Asia, North America, and Europe. By utilizing its geographic location bridging Southeast Asia and North America, Korean national flag carriers are attracting large amount of air cargo from North America and Southeast Asia. Backing up this record is the fact that there is a technical restriction in flying from Southeast Asia to the east coast of North America loading profitable payload.

Korean Air carried 570,926 ton in 2000 and 64.7% of the volume was transferred cargo. The volume decreased in 2001 to 514,574 tonnes (transfer ratio 64.4%), and 463,377 tonnes for ten months in 2002 (transfer ratio 64.8%). Asiana Airlines shows similar pattern as 227,128 tonnes in 2000 with transfer ratio of 61.0%, 206,075 tonnes in 2001 with transfer ratio of 59.1%, and 202,860 tonnes for ten months in 2002 with transfer ratio of 59.0%.

The annual growth rate averaged 9.6% for international air cargo for past ten years, which is higher than that of passenger traffic. In detail, although the volume of 1998 was reduced to about 90.1% of 1997's volume affected by Asian economic crisis, the volume leaped again at 16.9% in 1999, and 13.4% in 2000. In 2001, with the shock of Nine Eleven terror in America, international air cargo volume in Korea was decreased to 1,872 thousand tonnes at the rate of 4.0% compared to 1,949 thousand tonnes of previous year. Future air cargo volume is forecasted as 2,627 thousand tonnes in 2005, and 3,672 thousand tonnes in 2010.

Table 1. Korea's Air Cargo Trade ('000 tonnes)

Year	In-Out		Cargo		Total Throughput	% Change
	Inbound	Outbound	Freight	Mail		
1997	793	837	1,615	15	1,631	14.1
1998	635	835	1,451	19	1,470	-9.9
1999	765	953	1,698	20	1,719	16.9
2000	911	1,037	1,928	20	1,949	13.4
2001	862	1,011	1,846	26	1,872	-4.0

Source: *Korea Airport Cooperation.*

Importance of Air Cargo

World air cargo carriers can be segmented as combination air carriers and all cargo carriers. Although express carriers are growing very fast, combination carriers are still dominating air cargo market at about 75% of share. For whole world airlines, average share of cargo accounts to be 16% (P.S. Morrell and R.V. Pilon, 1999). In Northeast Asia, except Japanese Airlines, most airlines show higher share of air cargo revenue as 26% of Cathay Pacific, 33.7% of China Airlines, 30.9% of Korean Air, and 30.2% of Asiana Airlines. In general, yield of air cargo transportation is higher than that of passenger transportation because cargo

does not require complicated process such as in-flight service, ground service, and transfer service. Also airlines can utilize the belly space of passenger aircraft.

During 1990-2002, in Korea, although the annual growth rate of export averaged 7.0%, the rate of export by air was much higher at 12.5%. It is mainly because the export of so-called three major IT products (semi-conductor, computer, and cellular phone) was increased rapidly. When comparing air cargo and marine cargo, although air cargo accounted for about 0.34% by weight of all cargo in Korea, its value share was much higher at more than 32% in 2000. Japan and Hong Kong have similar structures. It means that even little diversion of marine cargo to air may enhance the role of air cargo greatly.

Forwarding Industry

The number of forwarding companies in Korea has grown rapidly after the alteration of competent authority from Ministry of Construction and Transportation to local governments. The explosion of the number of registered companies caused severe competition among forwarders and led average firm's size smaller. Easy conditions for registering as a forwarding company have difficulties in supervision after registration and produced large number of small firms. Small companies are often perturbing business transactions by offering dumping, rebates, and transactions in credit to shippers to attract cargo. With small capitals, some small forwarders have no capacity to build broad networks, and they are very weak to compensate for big claims. Consequently, they are becoming less competitive and losing market shares. Customs clearance, warehousing, and stevedoring should be worked as a system for efficient transportation. However, in Korea, forwarders are not allowed to do business for customs clearance, warehousing, and stevedoring. Forwarders' business is restricted to do collection and delivery of cargo. As shown in Table 2, although the number of registered forwarding companies in Korea was increased to 1,995 in 2001, average capital size and the numbers of employees are small. After the opening of forwarding market to foreign forwarders, the market share of foreign forwarders was increased to 65% in 2000 from 35% in 1999 and 23% in 1998.

Table 2. Number of Newly Registered Forwarding Companies

Year	1995	1996	1997	1998	1999	2000	2001	Total
Companies	160	140	460	170	258	532	275	1,995

Source: *Ministry of Construction and Transportation*, 2002.

Sea & Air Transportation

Korean Air inaugurated sea and air cargo transport from China via Korea in 1992. Since 1994, Asiana Airlines has also used this combined transport mode. It is such a pattern that cargo is consolidated in China, transported to Busan Port or Incheon Port by means of Korea/China liner routes. Then, the cargo is carried to Incheon International Airport for bonded transport in

Korea by trucks. Here, it is carried to the destinations, airports in North America, Europe, etc. by means of inter-modal transport. The cargo originated from China start mainly from Shanghai and carried to Busan Port using container ships or to Incheon Port using car-ferry ship. The cargo from Qingdao, Dalian and Tianjin, etc. are carried to Incheon Port using car-ferry ships and also the cargo from all over the world by air transport is carried to China via Busan or Incheon(Ye, 2002).

In the interim, due to shortage of cargo space provided by Chinese airlines and imperfect system of service, sea and air cargo transport was not greatly embossed, but its demand will be gradually increased together with the increase of demand for air transport cargo.

Especially, since China's rigid air transport policies and insufficient airport facilities, if Korea develops sea and air cargo transport, the differentiation of logistics services would be possible, which utilize Incheon International Airport in international logistics network of Northeast Asia.

Sea and air cargo from China are high-tech products which could not be transported by air from China with lack of aircraft space, some partial shipments over-flown from a ship which should be delivered urgently, and some seasonal goods to be delivered to North America and Europe for Easter, Christmas, and Thanksgiving Day. Sea and air cargo can curtail the transport time to North America to seven days (five days for express service) comparing to twenty days of sea transportation.

Korean Air showed explosion of sea and air cargo during 1992 and 1994 as 2,000 tonnes in 1992, 8,500 tonnes in 1993, and 12,450 tonnes in 1994. But latest statistics shows much lower achievements as shown in Table 3. The main reasons for this decrease are; lack of air cargo space departing form Korea, increased air cargo space from China, losing some cargo to competitor like Taiwanese airlines, excessive inland trucking time in Korea, and insufficient sea transportation service between China and Korea.

Table 3. Sea and Air Transport by Korean Air (tonnes)

	1997	1998	1999	2000	2001	2002.1~6
Sea & air	3,029	5,815	3,369	2,220	2,423	1,281
Air & sea	337	938	853	1,325	2,104	624
Total	3,366	6,753	4,222	3,545	4,527	1,905

Source: *Korean Air*, 2002.

Express Cargo

The annual growth rate of express cargo market averaged 20-30% in Korea for recent few years, which is much higher than that of worldwide growth. The market size is estimated as 100 billion Korean won in 1995 and 322 billion won in 2000. Further it is forecasted to be one trillion won in 2006. DHL, FedEx, TNT, UPS, so called 'Big Four', are dominating Korean express cargo market with 77.6% of market share. But their main business is express

package delivery rather than providing comprehensive logistics services.

Table 4. Market Share of Express Cargo in Korea (2000)

	DHL	FedEx	TNT	UPS	Others	Postal Service
Market Share (%)	37.3	15.5	12.4	12.4	9.3	13.0
Revenue (100 mil Korean Won)	1,200	500	400	400	300	420

3.2 Air Cargo Infrastructure

Only six airports including Incheon, Gimpo, Kimhae, Cheju, Kwangju, and Daegu have air cargo terminals, and their total area is 255 thousand square meters as shown in Table 5. Among them international cargo terminals are 216 thousand square meters (85%).

Table 5. Air Cargo Terminals and Cargo Volume (2001)

	Incheon	Gimpo	Kimhae		Cheju		Kwangju		Daegu
	Int'l	Domestic	Int'l	Domestic	Int'l	Domestic	Int'l	Domestic	Domestic
Area (m^2)	204,953	11,933	7,860	9,685	3,123	13,955	288	2,765	264
Capacity ('000 tonnes)	2,260	420	120	340	60	280	2.5	55	53
			(460)		(340)		(57.5)		(53)
Cargo Volume ('000 tonnes)	1,200	900	50	153	7.3	323	0.04	31	17.8

Source: *Korea Airport Cooperation,* 2001.

Air Cargo Facilities at Incheon International Airport

There are four cargo terminals operated by two national flag carriers and two warehouses operated by forwarders in Incheon airport. This separated structure and operation of cargo area has advantages in providing specialized services, and facilitates ground handling and warehousing by dividing the area into import, export and transit zones. Incheon airport has 2,260 thousand tonnes of cargo handling capacity, and it will be expanded to 2,660 thousand tonnes by 2004. The total area of two warehouses is 7,921 m^2 with 100 thousand tonnes of cargo handling capacity.

Two major differences in cargo handling process after the opening Incheon International Airport in 2001 are introduction of RFC (ready for carriage) and enhancement of bypassing function rather than storage function. Although the function as hinterland logistics park and city cargo terminal endowed to Gimpo airport for the better use of new cargo facilities in Incheon airport and existing facilities in Gimpo airport, cargo facilities in Gimpo airport are still poorly utilized.

Air Cargo Facilities at Gimpo International Airport

The area of cargo facilities in Gimpo airport is 96,547 m^2, that consists of warehouses for

import and export (43,099 m^2, 44.6%), warehouses for domestic cargo (18,590 m^2, 19.3%), warehouses for general purpose (11,436 m^2, 11.3%), and vacant warehouses (23,422 m^2, 24.3%). The operating efficiency of the facilities is very low as less than 30%. Although Korea Airport Cooperation is struggling to attract more forwarders and express carriers, situation is not so successful by now.

Customs Clearance Time

The efficiency of air cargo is closely related to customs issues. As customs administration performs two basic functions, trade facilitation and customs control such as prevention of infiltration of illicit drugs or hazardous materials, and tariff collection, it is not easy to shorten customs clearance time just for facilitation.

As can be seen from Table 6, the customs clearance time for importing cargo took 2.7 days for air cargo and 9.4 days for marine cargo in 2002 halved from previous year. But in strict meaning, customs clearance time is not critical in Korea. As only the stage from declaration to acceptance is under customs office's direct control, that are only 7.1% of total clearance time for air cargo. As arrival-to-entry and entry-to-declaration take much longer time, shippers cannot benefit from the improvement of customs administration.

Table 6. Comparison of Customs Clearance Times in Korea and Japan

		Arrival → Entry	Entry → Declaration	Declaration → Acceptance	Total
Air	Korea 2000	1.5days	4.2 days	2.2 hours	5.8 days
	Korea 2002	5.9hours	2.4 days	2.2 hours	2.7 days
	Japan	3.5 hours	21.6 hours	0.6 hours	1.1 days
Marine	Korea 2000	4.3 days	8.7 days	3.5 hours	13.1 days
	Korea 2002	1.8 days	7.4 days	3.3 hours	9.4 days
	Japan	35.1 hours	46.0 hours	5.6 hours	3.6 days

Source: *Korea Customs Service*, April 2002.

4. BARRIERS IN INCREASING THE EFFICIENCY OF AIR CARGO TRANSPORTATION IN KOREA

4.1 Air Cargo Industry

Airlines

Facing fierce competition, airlines are urged to expand global network through strategic alliances in air cargo transportation and need to adjust their schedules. Some leading airlines divided their cargo business as independent companies. Combination airlines should provide variety of services and need to strength competitiveness through the connection of cargo information system with forwarders to compete against integrators. To build efficient supply chain management system, it is important to curtail processing time, cost down in business

transaction and trade. However some problems arise in interfacing individual systems and external systems. The most critical problem is incurring additional costs for standardization.

Forwarders

After the opening of forwarding market to foreign forwarders in 1996, domestic forwarders are suffering from low profit and market disorder caused by dumping. As forwarders are not allowed to do customs clearance business, basically they have limits in improving their business structure. Further, standardizing of information exchange and building interfaces with airlines and shippers will occur additional costs to forwarders.

For sound competition and to clear market disorder, self-regulation by the industry or inducement of merge by government with some tax incentives are suggested. However such incentives for forwarding companies are against the principle of equity to other industries.

Even local governments do not have clear grasp of the practices of forwarding industry, and it is unclear which section is responsible for air cargo transportation in Ministry of Construction and Transportation.

The needs for computerization and fast information are increasing because not only cost but also time and information are in consideration as important factors. Although forwarders in Korea are well recognizing the importance of cargo information system, interface with airlines, customs office, shippers, customs accountants, and VAN operators has not been developed yet, and they are still relying on FAX and telephone. Since 2002, their information systems have been improved by building efficient interfaces and by using the Internet. However, forwarders are charged for using the system, and it is inevitable to pay higher fees with progression of air cargo information project.

Shippers

By moving international cargo business from Gimpo airport to Incheon airport, shippers' logistics cost was increased at about 25-30%. Further, though customs clearance process is automated using EDI service provided by KT-NET, shippers are paying both for EDI charges and tax accountants' fees. Although air cargo terminals are in operation for 24 hours a day, most importing cargo arriving after 6 pm can be processed in next day. Consequently, shippers are paying more cost than before.

4.2 Air Cargo Infrastructure

Air Cargo Terminals in Incheon Airport

Introduction of RFC requires spaces for consolidating. Although warehouse space is essential for forwarders, many forwarders except some big companies have not secured basic warehouses, facilities and managing systems. With lack of warehouse space at Incheon airport, many forwarders are working at car park for collecting and consolidating cargo.

In carrying forward the second expansion plan of non-dedicated air cargo terminal, some contradictory opinions regarding the location of warehouses and operation are not settled yet and cause delay. In some other Asian airports provide more space for warehouses than air cargo terminals (Check Lap Cock airport in Hong Kong and Changi airport in Singapore) or at least half space (Kuala Lumpur airport in Malaysia). In Incheon airport, warehouses for forwarders occupy only 15, $842\,m^2$, which is 8.4% of total area of cargo terminals (189, $111\,m^2$).

Air Cargo Terminals in Gimpo Airport

It is expected that Gimpo airport would process 28% of total air cargo after the opening of Incheon airport. However, far from the forecast, Gimpo handled about four thousand cases of exporting clearance, that is only 1.4% of Incheon's, and 243 thousand cases of importing clearance, that is only 6.2% of Incheon's.

The function of Gimpo airport as a hinterland logistics center of Incheon airport is poorly utilized by Incheon oriented business, unreasonably high rent at Gimpo cargo terminal, and lack of coordination among related government bodies.

Insufficient Access to Incheon Airport

As Incheon airport can be accessed by a bridge only, some areas including the southern part of capital region and Songdo New Town in Incheon have poor accessibility to Incheon airport. Although the second bridge is planned to be constructed by 2008, it is worried to be delayed as the project is promoted as private investments. For improving the accessibility to Incheon airport, a new highway connecting the second Kyungin Expressway and Incheon airport is in consideration. Further construction of Incheon airport rail should be opened by 2010 as planned and should not be delayed.

4.3 Air Cargo Transportation and Processing

Incheon airport showed some problems in cargo handling with short of cargo handling space for forwarders. Airlines could not thoroughly comply with RFC rule. Different procedures for inbound cargo between the two national flag carriers caused confusion. Forwarders would not prefer Gimpo air cargo terminal to be designated for customs clearance, as they have to pay for the bonded transportation between Incheon and Gimpo. In case of outbound cargo, handling cargo over consolidators at Incheon airport is less expensive than consolidating at Gimpo airport.

For efficient air cargo processing, Air Cargo Information System has been developed since 1999, and the system connects air cargo terminals, airport authority, and airlines' systems. Air Cargo Information System of Incheon airport provides various services on landing and departure administration, automation of cargo classification, cargo terminal operation, and

cargo reservation and tracing. But the system is not utilized as expected because it is not fully compatible to user's business environments and some users are satisfied with existing MFCS (Manifest Consolidation System). MFCS has problems in processing information as MFCS aggregates airlines' master airwaybill information. It is impossible to manage information by house airwaybill.

As Airlines are using CARGO-IMP standards, they need to do conversion works to be compatible with UN/EDIFACT EDI standard of KT-NET who is a service provider of Air Cargo Information System. Also, airlines' cargo information systems need to be adjusted to fulfill customs' requirements on manifests.

5. POLICES FOR INCREASING THE EFFICIENCY OF AIR CARGO INDUSTRY IN KOREA

5.1 Directions for Increasing Efficiency

As basic directions for increasing the efficiency of Korea air cargo industry, airports and airlines need to provide user oriented services. To do so, first of all, the desirable role and function of air cargo infrastructures should be set down among the air cargo community.

For increasing efficiency, as prerequisites, it is advisable to attract multinational logistics companies and EMS (Express Mail Service) hub which is in discussion among U.S. and five Asia-Pacific countries to airport hinterlands.

Another urgent task is development of Incheon airport hinterland to attract Northeast Asia logistics centers of European or American companies targeting China market. Building efficiently transport network linking airport and seaport is essential to provide choice of air transportation and marine transportation. To promote sea and air transportation, logistics infrastructure at airports and seaports should be improved continuously. In this context, planned airport railway and the second bridge of Incheon airport should be constructed timely.

Some major facilities for passengers are approaching saturation use, and air cargo terminals are also expected to run over their capacity within one to three years. A new air cargo terminal for non-exclusive use and a customs free zone will be constructed to meet increasing demands by Incheon International Airport Cooperation. However it is worried if rent would be high with difficulties in lowering construction costs.

Needless to say, proactive marketing strategies utilizing Incheon airport's advantages in linking other airports in Northeast Asia should be deployed. Airlines should be benefited from the strategies comparing to using other airports in competitions.

5.2 Recommendations for Increasing the Efficiency of Air Cargo Industry in Korea

Airlines

Airlines need to cut costs by building various hub-routes and spoke-routes connecting marine and inland transportation. Also, they need to set up door-to-door delivery systems for better profits by transforming into total delivery service providers and by adding more flights and destinations. Forming vertical alliances with regional air carrier or trucking companies and splitting their cargo business as independent companies could be considered. As core drivers of air cargo information, airlines may need to build efficient linkage with users such as forwarders and shippers.

Forwarders

Under current restrictions on forwarders prohibiting customs clearance business, warehousing and stevedoring, it seems very difficult to achieve improvement and variety in providing logistics services. The restriction should be released and for promoting fair competition and efficiency in the market, customs clearance business should be opened to foreigners as well.

Although government persuaded users would be benefited from logistics cost down when introducing EDI system, actual costs of users have increased. For the better use of information and to relieve user costs, government should consider to subsidize for the system.

Although it is not desirable to go against deregulation to solve disorder problems in forwarding market, government should intervene the market at minimum level to protect shippers.

Sea & Air Transportation

Sea and air cargo volume seems difficult to be increased in short term under present situation of insufficient aircraft cargo space. But if airlines supply more space and if container liners and car-ferry routes are increased in near future, sea and air cargo volume will be increased from the northeast China where potential demands are huge.

As demands for sea and air transportation are volatile with changing circumstances, it should not be of major policy issues. Hence providing more cargo space by flag carriers and attracting more foreign carriers are important. Further, for efficient sea and air transportation, building efficient EDI systems among customs offices at airports and seaports is vital.

Express Cargo

To be developed as logistics hub, attracting regional logistics centers of integrators who provide comprehensive third party logistics services should be emphasized. It is strongly recommended to fully liberalize the entry of cargo aircraft, to give cargo aircraft some reduction of airport charges, and to provide various incentives when building cargo terminals or logistics centers at Incheon airport.

5.3 Improvements and Construction of Air Cargo Infrastructures

Air Cargo Terminals

The most urgent problem is construction of warehouses at Incheon airport. The annual capacity of existing facilities for forwarders is only 100 thousand tonnes that is much smaller than their actual cargo volume of 520 thousand tonnes. Although construction of additional cargo terminal for common use is planned, the size of the terminal and participants are not decided yet. It will be reasonable to accept forwarders' investment proposal for the facility, and do additional adjustment for the actual size of the area.

As Korean government is driving a strategy for promoting Incheon airport as a Northeast Asian hub, it is not easy to make best use of existing facilities at Gimpo airport. Korea Airport Cooperation needs to advertise the fact that the rent of warehouse at Gimpo airport is much lower than the rent at Incheon airport, and need to promote users by improving leasing system.

Cargo Handling Process

Warehouses in landside need to be serviced by ground handling companies to improve ground-handling process at Incheon airport. To facilitate such services, customs office may consider designating the connecting road between ramp area in airside and warehouse in landside as bonded area. Until constructing additional warehouse, airlines may provide space for RFC work in their terminal area. Some land near cargo terminal in airside could be allowed to forwarders for efficient flow of cargo from forwarder's facility to airlines' cargo terminals.

Customs Clearance

Customs administration may be improved by providing one window service for importing and exporting to prevent double documentation. Differentiating policy on forwarders and shippers should be applied based on law-abiding and honesty. Low-scored users should get some penalties and high-scored users should be encouraged with various incentives. As users rate paperless customs clearance scheme high, the scheme should be applied to more eligible users. Automatic clearance scheme for importing cargo is applied to some large companies and some products only. It will be possible to apply more companies and products by improving computing system.

Air Cargo Information System

Arrival and departure administration service provided by Air Cargo Information System could not fully reflect the needs of sixteen government agencies in Incheon airport. After designating an exclusive operating company for Air Cargo Information System, the company needs to consult with airlines to expand the use of barcode system, to connect terminal system, and to expand air cargo reservation system. Air Cargo Information System should be connected to TRAXON, and should be improved to provide reservation and cargo tracing

services, online services for electronic payment of warehouse charges, query of delivery costs. When connected to e-logisframe of KT-NET, Air Cargo Information System will be able to process both government's administration and company's business. By providing e-logistics frame for air cargo dedicated system as a national infrastructure, users will be facilitated at low cost. Finally, Air Cargo Information System should be coordinated with new information system that will be built in Airport Customs Free Zone.

6. CONCLUSION

The global trend of companies outsourcing to suppliers in different parts of the world to take advantage of low labor and low material costs is very likely to continue. Companies will continue to find ways to reduce inventory costs by minimizing unnecessary travel time and unnecessary inventory items that are in transit, in storage facilities, and in the stores (Cheung, et a1. 2002). Major trends in global air cargo market can be summarized as forming strategic alliances in air cargo field among air carriers, developing information technology, and emerging integrators, etc. In Northeast Asia, air cargo volume will be increased rapidly with the growth of Chinese economy. Fierce competition among airports in Northeast Asia will be deployed to attract air cargo of the region.

In this paper, authors tried to tackle the strength and weakness of air cargo industry in Korea. The strength of Korea cargo industry lies in efficient air cargo infrastructures and competitive national flag carriers. We have tried to shed on each components of Korea cargo industry such as airlines, forwarders, and customs but also air cargo infrastructures, sea and air transportation, air cargo information system, and express cargo. Some weaknesses and barriers in strengthening the industry are analyzed.

Supplying user-oriented services, functional reinforcing air cargo infrastructure, and developing comprehensive master plan are taken as the basis for increasing the efficiency of air cargo transportation.

As prerequisites for increasing efficiency, it is recommended to attract multinational companies, to develop hinterland logistics parks, to construct additional airport access facilities, to carry forward plans such as expansion of air cargo terminal without delay, to carry out proactive marketing strategies. This study suggests some policy implications for increasing efficiency. Airlines need to continuously conclude strategic alliance and build global network, and to prepare for the progression of air cargo information system and for the development of new aircraft and routes. To provide fast and efficient logistics service, forwarders may need to be allowed to enter customs clearance business, to be supported for information system, and to be controlled after registration by government. It is also suggested to attract Northeast Asian regional hubs for international express carriers and express mail service as well as to improve sea & air transportation system. Finally, the improvements of air cargo terminals, RFC process, and customs clearance process are suggested.

REFERENCES

1. Boeing Company (2002) World Air Cargo Forecast 2002-2003-02-26.
2. Chestler, Larry (1985) Overnight Air Express: Spatial Pattern, Competition and the Future in Small Package Delivery Services, **Transportation Quarterly**, Vol.39A, No.1.
3. Cheung, Waiman, et al. (2002) Increasing the Competitiveness of the Air Cargo Industry in Hong Kong, **ITF Report** SSP/48/00.
4. DeLorme, P., Joseph Procter, Sundar Swaminathan and Todd Tillinghast (1992) Simulation of a Combination Carrier Air Cargo Hub, **Proceedings of the 1992 Winter Simulation Conference**.
5. Hall, Randolp (1989) Configuration of an Overnight Package Air Network, **Transportation Research,** Vol. 23A.
6. Hall, Randolp (1996) Pickup and Delivery Systems for Overnight Carriers, **Transportation Research**. Vol. 30A.
7. Kassilingam, R. G. (1996) Air Cargo Revenue Management: Characteristics and Complexities, **European Journal of Operational Research 96**.
8. Kiesling, Max K. and Mark M. Hansen (1993) Integrated Air Freight Cost Structure: The Case of Federal Express, Institute of Transportation Studies, Univ. of Berkeley, **Research Report UCB-ITS-RR-93-15**.
9. Kim, Daeki (1997) Large-scale transportation service network design: models, algorithms and applications", MIT Doctoral Thesis.
10. Kim, Jecheol and Choongyeol Ye (2002) Increasing the Air Cargo Industry in Korea, The Korea Transport Institute.
11. Kuby, Michael J. and Robert Gordon Gray (1993) The Network Design Problem with Stopovers and Feeders: The case of Federal Express, **Transportation Research**.
12. Murphy, Paul, Douglas Dalenberg, James Daley (1989) Improving International Trade efficiency: Airport and Air Cargo Concerns, **Transportation Journal.**
13. Verwijmeren, M. A.A.P., C. B. Tilanus (1993) Network planning for scheduling operations in air cargo handling: a tool in medium term goodsflow control, **European journal of operational research**, Vol. 70.
14. Ye, Choongyeol (2000) A Neural Network Approach to Air Cargo Fleet Assignment, Ph.D. Thesis, Loughborough University.
15. Ye, Choongyeol (2002) Development of Airport City as the Center of International Logistics, **Proceedings of the conference on Developing A Business Hub-city in Northeast Asia**.