

# A study on Improving Interconnectivity of Regional Logistics Markets in the Era of the Pan Yellow Sea Region

[From the Perspective of South Korea's Chungnam Province]

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## ABSTRACT

Based on changing global economy and logistics environment, this study proposes strategy for regional logistics inter-connectivity improvement in terms of economic utilization of Chungnam Province. The study uses GL Index to find the specialty of logistics flows between Chungnam and China. The results are summarized as follows. First, Chungnam needs to upgrade its sea port functions to be a logistics center for China. Second, it needs to open and extend car-ferry route for China. Third, it should reinforce multi-modal transport system between Chungnam's and China's sea ports in the Yellow Sea Region. Fourth, it needs to establish automobile assembly cluster for China in its sea port hinterlands. Fifth, it needs to attract Chinese enterprises for promotion of supply chain management and so on. South Korean government and its local government should quickly carry out the proposed strategies for promoting its economic growth through positive effects from Chinese economic growth.

**Key words:** Pan Yellow Sea Region, Chungnam Province, logistics center, Grubel-Lloyd Index, port, business model, supply chain management (SCM)

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# 1. Introduction

Globalization and intensification of international division of labor in world economy has been accelerating global trade volume expansion. Especially in the Asian region including China, consumer's expansion and increasing demands are expected to keep the growth rate of regional trade market persistently higher.

As the Pan Yellow Sea Region's economy, which includes South Korea's west coast and China's east coast regions, has risen in the 2000s, the weight of China in the world economy is expected to be kept heavier. It is reasonable to predict that South Korea, one of the geographically closest neighbors to China, will be influenced from this effect such as intensification of mutual exchanges. Particularly the Free Trade Agreement (FTA) recently concluded between the governments of the two countries is expected to make the Yellow Sea Region emerge as one of the most important logistics marketx in the Northeast Asian region.

In response to this change, Chungnam Province—located in the closest distance from China's east coast, and in the center of the Korean Peninsula—needs to develop effective strategies for logistical integration with China, which enables various added value creation through trade with China, and which should be based on its geopolitical strengths and well-defined characteristics. In contrast to this necessity, logistics policy conducted at local level has hovered around much limited and conventional activities—for example, improvement of port facilities, expansion of shipping routes, foundation of hinterland logistics centers, and domestically oriented marketing strategies. In order to revitalize port logistics market in the South Korea's central region connecting with China's one, it is essential to conduct more innovative activities such as identification of cargo groups and their related industries based on analysis of cargo movements between foreland and hinterland, and analysis of supply chain management (SCM) flow, which enable cargo groups and industries to be more effectively connected—as prerequisites for precise calculation of suitable facilities and appropriate functions for attraction of foreign enterprises.

Based on this presumption, this study conducts an analysis of regional logistics structure in the Pan Yellow Sea Region, giving attention to recent situation of China's logistics market and its relationship with South Korea's central region. For this purpose, the study adopts Grubel-Lloyd (GL) Index tool, one of the most popular methodologies regarding trade specialization analysis using port traffic data, in order to discover categories of industries capable of added value creation and possibility to interconnect Chungnam Province's logistics system with Chinese one.

By doing so, the study attempts to provide some policy-relevant recommendations for making Chungnam Province a logistics hub toward Chinese east coastal region in the era of the Pan Yellow Sea Region.

## 2. Theoretical background and Literature Review

### 2.1. Definition of “the Pan Yellow Sea Region”

Although the conceptual definition of the “Pan Yellow Sea Region” has not yet fixed in undisputable fashion, but in geographical term, there exists a acceptable consensus. A report recently issued in China (The Organization for the East Asian Economic Development, 2012) puts it as “all of the coastal regions including South Korea’s west coast, Japan’s southwest coast.”<sup>1)</sup> Considering focus areas, and for the purpose of research convenience, this study excludes Japan’s west coast, while, at the same time, including Chungnam Province (except for Gyeonggi Province) in South Korea, and Chinese Bohai Bay region.

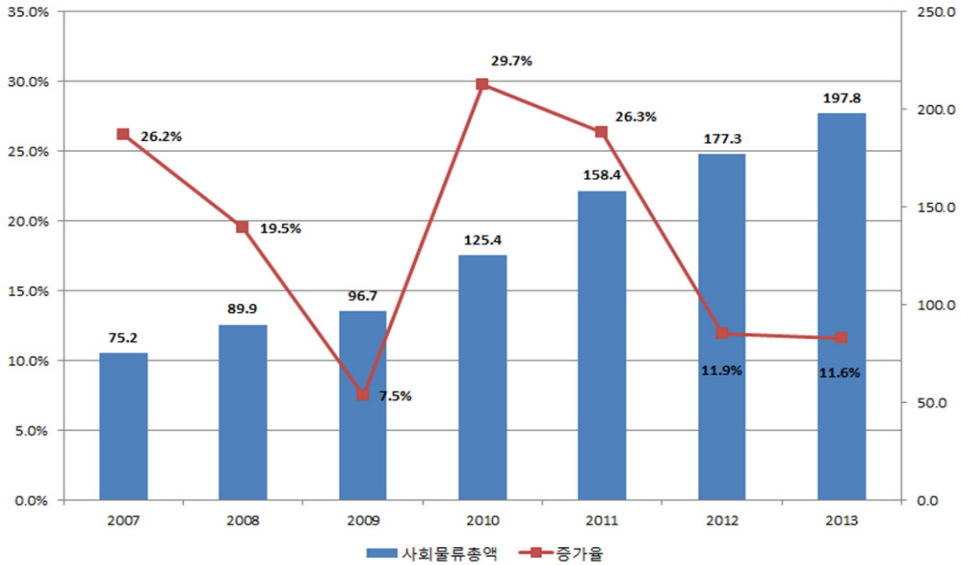
### 2.2. Logistics Trends in the Pan Yellow Sea Region

#### 2.2.1 Logistics market in China

Based on the 12th Five-year Plan (2011-2015, “12.5 Plan”), PR China has been pursuing balanced developments between urban and rural areas, sustainable urbanization, and logistics modernization simultaneously as its urgent priorities. Whilst not one of the seven strategic investment industries<sup>2)</sup>, the transport and logistics sector has a huge meaning for the successful achievement of these goals and implementation of the 12.5 Plan itself. Especially for achieving the goal of the balanced urban-rural development, China has adopted urbanization by designation of industrial and/or economic bases at national level, and, to this end, has pursued construction of modern transport and logistics networks.<sup>3)</sup>

Between 2006 and 2013, China’s total value of its nationwide logistics sector is as shown in the Figure 1. Except for 2009 when global financial crisis dealt a fierce blow, Chinese logistics sector maintained double digit growth in the same period by annual growth rate of 18.7%—mainly due to the increasing demands from industrial sectors and the expansion of domestic retail and consumer markets. In 2013, the total value of social logistics in China increased by 11.6% with RMB 197.8 trillion yuan compared with its previous year. Furthermore, according to World Bank statistics such as Logistics Performance Index (LPI), the overall performance of logistics in China has continuously been improved.<sup>4)</sup>

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- 1) DongHyun Lee, Woochul Ahn, “A Study on the Selection of Port Alliances through Analyzing the Container Cargo Flows between Ports in the Pan-Yellow Sea,” *International Commerce and Information Review*, Volume 16, Number 2, March, 2014, p. 159. One the other hand, a OECD report (2009) includes South Korea’s south coast (including Ulssan and Busan), and Japan’s Kyushu Island (including Fukuoka) and part of Hoshu Island (including Shimonokei).
  - 2) Seven strategic emerging industries (SEIs) includes: energy saving and environmental protection; new generation of information technology; biotechnology; high-end equipment manufacturing; new energy; new materials; and new energy vehicles. Ping Gong and Jessica Wang, “China’s 12the Five-Year Plan: An Overview,” May 18, 2011.
  - 3) 中央政府门户网站(www.gov.cn), 「国民经济和社会发展第十二个五年规划纲要(全文)」, March 16, 2011.



Source: National Development Reform Commission.

**Figure 1.** The values and growth rates of social logistics sector in PR China (2006~2013)

China’s logistics market is expected to continue higher growth rate than those of macro-economic indicators in China’s national economy—despite recent slowdown of macro-economic growth rate—mainly led by several factors: the quality improvement of domestic markets, continuation of balanced development, advancement of urbanization that would likely boost construction and social infrastructure sectors. Moreover, Chinese production network has also experienced significant structural changes along with its trade patterns—namely, from “inter-industry trade” to “intra-industry trade.” In this respect, the future growth and structural improvement in China’s logistics industry should have a significant impact on South Korea’s economy, which relies its international trade heavily on China, while, at the same time, playing a crucial role in South Korea’s efforts to discover new opportunities of value creation in its international logistics sector.

### 2.2.2. International logistics system in the Pan Yellow Sea Region

Maritime cargo traffics in the Pan Yellow Sea Region has experienced a persistence increase in recent years, while, at the same time, air traffics did so but in more rapid pace among China, Japan, South Korea, and the ASEAN countries. With heating competition for international logistical hubs in the Northeast Asian region, and as a result, competitions for expansion of sea port and logistical facilities are becoming more fierce.

4) According to World Bank, China’s rank in terms of logistics performance has steadily climbed from 30th in 2007 to 24th in 2014. See to The Logistics Performance Index and its Indicators, World Bank. [http://siteresources.worldbank.org/TRADE/Resources/239070-1336654966193/LPI\\_2014\\_final.pdf](http://siteresources.worldbank.org/TRADE/Resources/239070-1336654966193/LPI_2014_final.pdf)

Competitions for attracting foreign direct investments are accelerating as well. For example, China puts its energy into developing Waigaoqiao Bonded Area in Shanghai sea port, Large and Small Yangshan Hinterland Logistics Complexes, and the Special Economic Zone in Shenzhen. Japan has also been implementing its “Super Hub Port” project, which aims at reducing port costs by 30% and shortening lead time from three or four days this day to approximately one day, by improving the efficiency of port operation.<sup>5)</sup>

Apart from governmental level’s efforts, global logistics giants such as DHL and TNT are competitively constructing or planning specialized cargo terminals in major airports in the Northeast Asian region. Global shipping companies are implementing their own strategies for expansion of their logistics services and networks mainly by doing consolidation of their own alliance, introduction of ultra large containerships, and through this way, reduction of ports of call.

On land, designation and construction of free trade zones (FTZs) for improving efficiency of logistical operations and, by doing so, attracting global firms, are increasing in their respective port regions. For instance, since 1990s, China has been running more than 15 free trade zones along its east coast—mostly located in its port regions. Apart from the FTZs, various forms of development zones such as SEZs and Coastal Economic Opening Zones along the China’s east coast have been opened or being operated.

### 2.2.3. Impacts on South Korea in the regional logistics sector

Persistent growth of Chinese logistics market has been, and is being driven by inflows of foreign capital into China as well as by the enormous expansion of its domestic demands. In this respect, South Korean firms, located closely to China, have been accessing to Chinese market. Especially this phenomenon has been consolidated by acceleration of international division of labor, inter- and intra-industry trades, and intensification of supply chain in the manufacturing sector with improved inter-connectivity of China, Japan, and South Korea as its center.

On the basis of 2012, about 4,000 South Korean firms entered into their businesses in China. Among them, manufacturers account for about 80% (3,416 firms), many enough to say that South Korean firms’ entry into China has been led mainly by manufacturing sector. Most of the firms headquarter South Korea, and/or have a close business relationship with their homeland.<sup>6)</sup> As the bilateral trade volume increases, interaction of logistical systems across the Yellow Sea is growingly increasing.

As the level of consumption goes up in China’s coastal region, wholesalers, retailers, and service providers from South Korea are running into China for finding their business opportunities. Among them, increase of logistics-releting businesses such as distribution, transportation, and warehousing can be seen as a reflection

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5) The Super Hub Port Project was introduced by the Ministry of Land, Infrastructure, and Transport, in Japan, in 2004. Six major ports, Tokyo, Yokohama, Nagoya, Yokkaichi, Osaka, and Kobe, were selected as “Super Hub Port.” See to Pookong Kee and Hudetaja Yoshimatsu, eds., *Global Movements in the Asia Pacific*, World Scientific Publishing Co., 2010, p. 292.

6) *Overseas Korean Business Directory: China 2011-2012*, KOTRA, 2012.

of process that has been reinforced by the increase of merchandise trade and business partnerships between Chinese and Korean manufacturers. International division of labor accelerates not only in the exchange of varieties of end-products in different industries (inter-industry trade) but also parts and components in the same industry (intra-industry trade), which means the growing importance of international logistic markets between South Korea and China in the Pan Yellow Sea Region. Accordingly, South Korean local governments—especially located in the Pan Yellow Sea Region—need to cope with this importance by making efforts to devise effective and efficient measures to improve the inter-connectivity with Chinese market, and taking up benefits from added value creation.<sup>7)</sup>

### 2.3. Literature Review

Various researches and studies relating to the Pan Yellow Sea Region have been conducted and produced since the early 2000s when its regional economy has emerged rapidly and its economic integration driven by market forces has been advanced. Most of the researches have a common interest in laying out inter-connectivity and economic cooperation of respective economies between local governments in both sides of the Yellow Sea. On the other hand, Empirical study on the measurement of intra industry trade began in the mid1960s with Balassa(1966) And the most well-known study is Grubel and Lloyd(1975).

A wide array of research outcomes exist in various forms, studies focusing on international logistics sector in the region can be said to be relatively scarce. Through an analysis on the international division of labor structure, Lee S.W. et al(2007) suggests growth directions for sea port hinterland industrial zones in South Korea, but the study does not give much attention to the issue of the growth of international logistics markets reflecting inter-connectivity between South Korea's and China's logistics systems. Kyoung C.S. and Hwang J.H. (2011) attempts to provide estimations over future cargo traffics changes in the region based on the international trade, and from South Korea's perspective. In this study, however, there exists some limitation—especially in terms of comparative analysis focusing Chinese market.

Not only in the logistics sector but also Chungnam Province's status in, and relations with, the Pan Yellow Sea Region, there exists a great deal of insufficiency—in terms of research focus, and in terms of comparisons between research demand and supply.

Yim Y.T. (2013) provides successfully future direction for logistics industry in Chungnam Province, giving attention to the importance of preparations for the era of the Pan Yellow Sea Region. A limitation of this study, however, is that the study focuses on offering complementary measures to reduce problems that South Korea's domestic logistics market faces rather than highlighting the inter-connectivity of logistics systems across the Yellow Sea. In the case of Lee D.H. and Ahn W.C. (2014), whilst the authors do successfully select target ports for “strategic alliance” in the

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7). Sungwoo Lee et al., A Study on Strategies for Attraction of Foreign Enterprises, Korea Maritime Institute, 2007, pp.304~306.

region, the study has a relative lack of discussions on the issue of establishment of more concrete implementation strategy for cargo traffic attraction—especially considering import/export goods produced by manufacturers located in port regions and its linkage with cargo traffic attraction.

**Table1.** Selected studies on the Pan Yellow Sea Region

Author(s)	Main research subject
Balassa (1966)	First proposed the index of intra industry trade that measured the degree of trade overlap using the import and export values
Grubel and Lloyd (1975)	Proposed an improved index, Grubel-Lloyd index can calculate a value/weight to measure the degree of intra industry trade of the Country level
Lee Sungwoo et al (2007)	Suggestions for growth direction of South Korea's hinterland industrial zones through analysis on the international division of labor among South Korea, China, and Japan
Gyeonggi Research Institute(2008)	Suggestions for the economic cooperation in various economic areas including industry and international trade sectors, focusing on cooperative and complementary roles between South Korea's west coast and China's east coast regions.
Kim Kunsoo, Kang SeungWoo (2008)	Economic cooperation among local governments in the Pan Yellow Sea Region
Han Jiyoung et al (2010)	Analysis on Networks between China's three core economic regions (Bohai Rim, the Yangtze River Delta Region, et.) and South Korea's west coastal region. Suggestions for linkages of multi-modal transport systems (rail and shipping) and joint development of relevant infrastructure (SOC) between China and South Korea
Kyung Jongsoo, Hwang Jeonghyeon (2011)	Suggestions for laying out logistics networking strategies reflecting transport system, distribution system, industrial development level, and other economic condition in Chungnam Province, and linking it with the Pan Yellow Sea Region economy
Yim Yongtae (2013)	Future-oriented development strategies for logistics sector in Chungnam Province preparing for the era of Pan Yellow Sea Region
Yeo Kitae et al (2013)	Analysis on port competition in the Pan Yellow Sea Region by introduction of Hirschman-Herfindahl Index for analyzing port concentration and dispersion in the region
Lee Donghyun, Ahn Woochul, (2014)	Selection of strategic alliance target ports by analysis on container traffic flows of Pyongtaek, Dangjin, Incheon, Gwangyang ports to/from other major sea ports in the Pan Yellow Sear Region

In order to reduce such limitations, this study attempts to provide suggestions for development of international logistics hub as well as for the improvement of inter-connectivity between Chungnam Province—a core sub-region located in South Korea—and Chinese west coast region.

### 3. Analysis of logistics potential in the Pan Yellow Sea Region

#### 3.1. Cargo traffic volume analysis: Chungnam Province-China

##### 3.1.1. Major Import/Export Goods(value, weight)

As seen in Table 3, goods ranked as the top 20 (on the basis of weight and the HSK 2 digits ) account for a range of 95-97% in total import/export goods of Chungnam Province to/from China in terms of value and weight. Compared with the fact that the top 20 goods account for a range of 74-91% at national level, this statistics obviously shows that the Chungnam Province relies its total goods trade with China heavily on a relatively small number of goods.

According to the statistics, in the years from 2008 to 2012, the total amount of value in Chungnam import/export from/to China has been gradually increasing, but the total amount of weight, decreasing<sup>8)</sup>. In the year of 2012, on the basis of the HSK<sup>9)</sup> 2 (digits), and import/export weights, organic chemicals (Code: 29) ranked as the top and followed by “Mineral fuels, mineral oils, mineral waxes, and bituminous sub”(Code: 29), “plastics and articles thereof”(Code: 39), “iron and steel”(Code: 72), “salt, sulfur, earth & stone, lime & cement”(Code: 25).

In the list of the “Top 5” articles, “Mineral fuels, mineral oils, cokes, mineral waxes”, which has once ranked as the top 1st in 2008 by 7.62 million M/T (weight), has gradually reduced its traded weights to 1.45 million M/T in 2012. On the other hand, “organic chemicals,” which have shown a slow upward trend in the trade with China, have eventually reached the highest rank.

The total amount of value of the top 20 articles classified by HSK 2 in 2012 increased from USD 19.3 billion dollars to USD 29.0 billion dollars, but the total weights decreased from 13.42 million M/T to 6.48 million M/T in the same period. From the overview of the top 20's ranking change above, which account for overwhelming majority of the total cargo traffics, it can be found that Chungnam Province's trade pattern with China has moved with a direction of traded cargo volume reduction but expansion of value amounts. A similar pattern or trend can be found in the international trade between South Korea and China at national level—conspicuously with a huge reduction of mineral fuels in terms of import/export volume (particularly import from China), which is usually seen as “lower added value.” The outcome of this overview means the necessity of additional research efforts such as cause

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8) The total import/export value increased from 19.9 billion dollars in 2008 to 29.9 billion dollars. On the other hand, the total volume decreased from 14.08 million M/T to 6.66 million M/T during the same years.

Harmonized System (HS) is the acronym of “Harmonized Commodity Description and Coding System” adopted by an international convention (shortly referred to the “HS Convention”) in 1988. The objective of the HS is to promote the international trade by harmonizing commodity and products classification systems with a six-digit code system for classifying traded goods, and keep coherency of tariff rates. The HS is widely used in various areas such as tariffs, trade statistics, transportation, and insurance. The HSK (“Harmonized System of Korea) is the Korean variation, which uses basically 6 digits code but, in case of necessity, 10 digits to specification.



analysis on factors impacting on rapid decrease of the traded cargo volume, which must be instructive to develop new business models for additional cargo creation, and attract new enterprises for added value creation from the perspective of international logistics inter-connectivity.

**Table 2.** Major import/export goods of Chungnam Province and China (value, weight)

(Unit: USD Million, M/T)

Rank (weight)	HSK 2	Article(s)	2008		2012	
			value	weight	value	weight
1	29	organic chemicals	1,942	1,625,348	3,320	2,379,203
2	27	mineral fuels, oils, wax & bituminous sub	2,175	7,623,455	1,417	1,454,133
3	39	plastics & articles thereof	984	562,904	1,275	645,277
4	72	iron and steel	556	634,371	423	535,663
5	25	salt, sulfur, earth & stone, lime & cement	38	229,322	77	468,386
6	68	articles of stone, plaster, cement, asbestos, mica or similar materials	40	120,398	42	133,045
7	28	inorganic chem., org/inorg compounds of precious metals, isotopes	141	79,121	188	105,819
8	90	optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments & accessories	3,931	44,410	7,616	89,906
9	87	vehicles other than railway or tramway rolling stock	209	34,353	869	79,779
10	26	ores slag & ash	-	-	3	77,874
11	85	electrical machinery & equip, & parts, telecommunication equip., sound	3,385	64,553	11,073	76,063
12	84	nuclear reactors, boilers, machinery & mechanical appliances, computers	1,029	47,730	2,292	73,210
13	48	papers & paperboard, articles of paper pulp	47	48,164	58	58,561
14	69	ceramic products	13	24,106	43	57,586
15	73	articles of iron or steel	65	40,501	93	55,518
16	31	fertilizers	42	95,906	25	55,296
17	38	miscellaneous chemical products	78	69,153	78	45,312
18	23	residues from food industries, animal feed	27	99,779	11	33,354
19	76	aluminum & articles thereof	20	4,900	100	30,800
20	7	edible vegetables	9	16,397	17	27,398

Source: Korea International Trade Association (KITA), 2013

Note: 1) weight unit as 1,000kg equals 1 ton

### 3.1.2. Major import/export goods (G/L Index)

Usually, intra industry trade is shown as the simultaneous export and import value in the same industry. As described before, Balassa (1966) first proposed the index of intra industry trade and Grubl-Lloyd (1971) developed the methodology.

The Grubl-Lloyd (1971) index measures intra industry trade of a particular product. The formula is as follows:

$$GL_i = \frac{(X_i + M_i) - |X_i - M_i|}{X_i + M_i} = 1 - \frac{|X_i - M_i|}{X_i + M_i} \quad ; \quad 0 \leq GL_i \leq 1$$

If  $GL_i = 1$ , there is only intra-industry, no inter-industry trade.

This means for example the Country in consideration Exports as same quantity of good  $i$  as much as it Imports.

Conversely, if  $GL_i = 0$ , there is no intra-industry trade, only inter-industry trade. This would mean that the Country in consideration only either Exports or only Imports good  $i$ .

As shown in the Table 4, G/L Index values of major import/export goods (on the basis of HSK 2 and weight) are respectively as follows: “iron and steel” ranks the 4th by 0.706, “salt, sulfur, earth&stone, lime&cement” ranks the 5th by 0.800, “inorganic chem., org/inorg compounds of precious metals, isotopes” ranks the 7th by 0.742. “ores slag and ash” ranks 10th by 0.588. Among others, “electrical machinery&equip, & parts, telecommunication equip, sound” (G/L Index value: 0.972), “nuclear reactors, boilers, machinery & mechanical appliances” (G/L Index value: 0.676), and “papers & paperboard, articles of paper pulp” (G/L Index value: 0.901) marks values higher than 0.5 in G/L Index terms.

Meanwhile, “aluminum & articles thereof,” which marked G/L Index value 0.571 (on the basis of weight) in 2008, began to go down lower than 0.5, and eventually marked 0.307 in 2012. In the case of “mineral fuels, oils, wax & bituminous sub,” the G/L Index value in Chungnam-China scores less than 0.5, contrasting with that of South Korea-China (G/L Index value: more than 0.5) at national level.

**Table3.** Major import/export goods of Chungnam Province and China (G/L Index)  
(Unit :USD million , MT<sup>1</sup>)

rank (weight)	HSK	Articles	2008		2012	
			value	weight	value	weight
1	29	organic chemicals	0.088	0.034	0.071	0.015
2	27	mineral fuels, oils, wax & bituminous sub	0.972	0.498	0.130	0.130
3	39	plastics & articles thereof	0.132	0.042	0.118	0.071
4	72	iron and steel	0.540	0.499	0.771	0.706
5	25	salt, sulfur, earth & stone, lime & cement	0.947	0.863	0.831	0.800
6	68	articles of stone, plaster, cement, asbestos, mica or similar materials	0.450	0.222	0.381	0.091
7	28	inorganic chem., org/inorg compounds of precious metals, isotopes	0.610	0.836	0.574	0.742
8	90	optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments & accessories	0.012	0.040	0.035	0.060

rank (weight)	HSK	Articles	2008		2012	
			value	weight	value	weight
9	87	vehicles other than railway or tramway rolling stock	0.478	0.324	0.136	0.155
10	26	ores slag & ash	-	-	0.667	0.588
11	85	electrical machinery & equip, & parts, telecommunication equip., sound	0.318	0.975	0.127	0.972
12	84	nuclear reactors, boilers, machinery & mechanical appliances, computers	0.301	0.932	0.156	0.676
13	48	papers & paperboard, articles of paper pulp	0.809	0.895	0.897	0.901
14	69	ceramic products	0.000	0.006	0.047	0.006
15	73	articles of iron or steel	0.462	0.329	0.581	0.320
16	31	fertilizers	0.000	0.001	0.000	0.001
17	38	miscellaneous chemical products	0.718	0.175	0.795	0.181
18	23	residues from food industries, animal feed	0.000	0.002	0.000	0.006
19	76	aluminum & articles thereof	0.700	0.576	0.540	0.307
20	7	edible vegetables	0.000	0.002	0.000	0.000

Source: Korea International Trade Association (KITA), 2013

Note Leaned mark shows the articles' G/L Index value is more than 0.5 only in the Chungnam-China trade. Articles scored G/L index more than 0.5 in the table are included in the top 20 traded goods (on the basis of weight) in South Korea-China trade. Underlined articles are less than 0.5 of G/L Index in Chungnam-China trade but more than 0.5 in South Korea-China trade. Bold marked articles are more than 0.5 of G/L Index on both bases of value and weight.

The articles such as “iron and steel,” “salt, sulfur, earth & stone,” “inorganic chemicals,” “ores slack” show their characteristics as intra-industry trade goods stronger in Chungnam region than in others. Accordingly, it can be interpreted that, in the case of Chungnam region, processing industries using iron&steel, and nonferrous minerals (demanded for mid- or lower technological level) as well as chemical industry (demanded for mid- or higher technological level) would be more relatively favorable for international division of labor. In contrast, “organic chemicals,” “plastics,” “articles of stone, plaster, cement etc.” show their characteristics as inter-industry trade, despite larger creation of trade volume.

Therefore, it is reasonable to say that, in order to capture more opportunities for continuous cargo volume creation and at the same time, intensification of international division of labor, the Chungnam Province needs to invigorate the industries having stronger traits of intra-industry trade. Particularly, the industries related to the articles with higher scores in G/L Index in both aspects of value and weight such as “iron and steel,” “salt, sulfur, earth & stone,” and “inorganic chemicals” can be said to have relatively greater ripple effects on Chungnam Province's domestic economy. In addition, in order to establish more

concrete strategies, Chungnam Province needs to select sub-articles in the relevant classifications to bring up strategic industries, and pursue upgrading of industrial level in order to make added value creation possible.

### *3.2. Analysis of trade structure and selection of prospective businesses*

Considered from the analysis of the trade structure with China and its own industrial structure as shown above, the most prospective industry with huge potential would be the electrical machinery manufacturing industry, which has a close relationship with the article of “electrical machinery & equip, & parts, telecommunication equip., sound.” Having its characteristics as intra-industry trade stronger, in the basis of weight, G/L Index value of “electrical machinery & equip” approaches closely “1” by the value of 0.972. In fact, the electronics industry is employing the largest bulk of labor force in Chungnam Province’s manufacturing sector. Its employing rate is 20.38% of the total employment in Chungnam region. Along with this, and from the perspective of trade value amounts, the industry represents the largest in Chungnam Province’s trade with China.

The electronics industry has a great influence on the regional economy in Chungnam region. A close examination into the import/export structure of this article (“electrical machinery & equip”) between the Chungnam Province and China enables this argument to be more persuasive. The import weights of the article by Chungnam are larger than its export weights to China, but the value amounts of export are larger than those of import. This means that Chungnam imports the article at a lower cost (which is produced at a relatively lower skill level), while exporting the article at a higher cost (after processing and/or producing it at a relatively higher skill level).

The article “iron and steel” (G/L Index value 0.706 on the basis of weight) has a significance in Chungnam region’s international logistics as well. Metal related industries in Chungnam region show higher employment shares. The number of labor force employed in metal processing industry (except for machinery and appliance), in the primary metal industry, and in non-metallic industry account respectively for 5.92% (12,952), 5.73% (12,537), 5.32% (11,625) in the total employment of Chungnam Province. From the G/L data review above, it can be concluded that these industries have the potential for additional creation of cargo volume and for a ripple effect on the regional economy (job creation and increase of income). Imported iron and steel can make additional cargo creations in the aspect that the commodity is being demanded by other connected industrial sectors such as follows: “cars and trailers” (employs 14.71% of total labor force in Chungnam’s manufacturing sector), “other machinery and equipment” (employs 8.84%). Therefore, Chungnam region can conceive a business model following three steps: a. it imports mid- or lower quality of iron and steel needed as semi-products; b. it restructures and upgrades its iron and steel-related industrial group(s); c. the upgraded industries produces higher-quality steel products by processing the imported commodities. In this case, however, further studies—ranging from import to export, still to distribution, will be needed for a

more plausible business model.

The commodities “salt, sulfur, earth&stone, lime&cement” (G/L index: 0.800), “inorganic chemicals, precious metals etc.” (G/L index: 0.742) deserves much attention from the revitalization of Chungnam region’s international logistics, and its improvement of inter-connectivity.

In the aspect that the “non-metal mineral product” industry employs 11,625 (5.23% of the total employment)<sup>10)</sup>, “chemicals and products” (except for medicine) employs 11,168 (5.11%)<sup>11)</sup>, these industries can be seen as closed inter-connected with the regional economy in Chungnam Province. The article “papers, paperboards, pulp etc.,” which has the G/L Index 0.901 (on the basis of weight) is worthwhile to be considered, in the sense that the article has a close relationship with pulp industry, printing, and document copying industry, showing its characteristics as intra-industry trade goods.

In short, Chungnam Province needs to encourage added value creation activities by selecting industries that have been vibrantly achieving international division of labor with China as priority, and with consistent efforts for improving their technological capacities.

## 4. Conclusion and Recommendations for Chungnam Province

The emergence of the Pan East Sea Region and the maturation of regional economy in the Pan Yellow Sea Region are expected to be the key driving force in growth and expansion of global logistics market. Especially the international logistics market in the East Asia is expected to continue its rapid economic growth mainly due to stunning pace of growth in intra-regional trade mainly led by three relationships such as China-Japan, China-Korea, Korea-Japan—despite that China’s dependency on Korea and Japan has continuously decreased since the 1997 Asian Financial Crisis. Accordingly, the question of how to utilize Chinese market and gain benefits will be a daunting task in terms of expansion of logistics market share from South Korea’s perspective.

From this point of view in general, but from the perspective of Chungnam Province, which is located in central part of South Korea, this study suggests measures for profit maximization by improving logistical linkage with Chinese west coast. To this end, the study introduces G/L analysis to understand international trade pattern and structure between Chungnam and China more precisely, and then, suggests pathways to work for Chungnam Province in terms of reinforcement of value chain in international logistics system between Chungnam and China.

In order to become a critical logistical hub toward China, it is essential for Chungnam region to improve various kind of logistics infrastructure including port

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10) *Statistical Yearbook 2012 (52th edition)*, Chungnam Province, 2013.

11) *Abid.*

facilities, transport infrastructure such as roads and railways connecting ports and industrial parks, logistical centers, and cargo terminals. Based on these improvements, Chungnam needs to select and rear the industries that have great potential for continuous cargo creation, job creation, a ripple impact, and for growth of domestic economy. In order to address these tasks, Chungnam region might need to have strategies as follows:

First, in order to become a significant logistical hub, Chungnam needs to upgrade its ports capacity. A central element for this goal is to make appropriate port hinterland, which is focused as a foundation for cargo creation, added value activities, and job creation. Dangjin and Daeshan Ports need to secure their own hinterlands suitable for their regional industrial structure and capable of inviting various kinds of enterprises.

Second, establishment and expansion of car-ferry route to China will be needed. Chungnam has already prepared for shipping route to China with port development—targeting Daeshan Port. General shipping route, however, in this case, Chungnam is situated in more interior position. In contrast, the car-ferry route will be more competitive in the sense that there exist little competition frequency, and that the car-ferry route is easily connected with the industrial condition in Chungnam region. If the car-ferry route established, the route will compete for market share with the existing Incheon and Pyongtaek Ports in Gyonggi Province, but these rival ports have car-ferry routes linked to China's northeast region such as Shandong, Tianjin, and Dalian. If the car-ferry route connected to southward the Shandong Province such as Yanyunjiang (Jinagsu), Shanghai, Ningbo (Zhejiang), Chungnam can gain competitiveness, avoiding fierce competitions with other Korean ports. As shown in the analysis above, electronics that Chungnam has comparative advantage can find the opportunities for cargo creation, mainly because the majority of commodities—especially electronics and electrical goods—is using the existing car-ferry route.

Third, Chungnam needs to improve its inter- and multi-modal transport capacity—especially focusing on expansion of trucking with China. As mentioned above, trailers' access by trucking to Jiangsu, Shanghai, and Zhejian regions can improve the accessibility and stability of Chungnam ports, and as a result, can contribute to enhancement of their port competitiveness. The one important aspect that deserves attention is that trucking cargoes in Northeast Asian countries are the same with the cargoes produced in port regions of Chungnam Province—electronics and electrical appliances etc. These cargoes have a great significance to inter-connect forelands and hinterlands.

Fourth, automobile industry related cluster—especially parts production needs to be established behind the logistical hub. Pyongtaek and Dangjin Ports have already played their role as export base of Korean cars to China as well as import base of foreign cars. Significant operations regarding the business are, however, run in terminals in Pyongtaek Port. In order to re-balance the car trading industry at national level, and improve Dangjin Port's functions, Chungnam needs to consider the establishment of car parts cluster between its Dangjin Port and Pyongtaek Port.

Fifth, supply chain between Chungnam region and China should be reinforced by the efforts to attract Chinese enterprises into Chungnam coastal regions. Establishment of seamless supply chain is essential for consolidation of international

division of labor. Chungnam Province is no exception. The formation of parts production in China and final goods in Chungnam should be compensated with reverse formation—parts production in Chungnam and final goods in China if the Chungnam pursue for logistical hub in the Pan Yellow Sea Region. It is because the formation and reverse formation will help Chungnam's ports to increase cargo creation. For inviting Chinese companies, Chungnam needs to make business and profit models considering costs and benefits, and time and distance.

Sixth, contemporary logistics emphasized seamless flows of goods as well as information. Chungnam Province needs to consider the establishment of cyber trade market, which might consist of, and link with exporters, manufacturers, mid- and small-size production associations, distribution networks in China. The cyber trade market will facilitate movements of cargoes between Chungnam region and China, and more importantly, begin to use the ports and logistics companies in Chungnam region.

Seventh, for becoming a major logistics hub, Chungnam needs to consider networking of logistics in China. Apart from attraction of Chinese firms and cargo invitation efforts, aggregation of cargoes toward Chungnam in China, and to this end, the establishment of joint logistics centers in China has a great necessity, especially considering inbound/outbound logistics. The logistics center which will be established, and operated by Korean firms jointly, will offer the opportunity of sharing information needed to link it with operations and management of logistics facilities located in Chungnam for efficient supply chain management and demand forecasting.

This study aims to propose the benefit maximization strategies for Chungnam Province mainly by linking its logistics system with Chinese one, and by utilizing the wave of China's economic rising in the Pan Yellow Sea Region. The study, however, needs complementary research efforts—for example, application of econometric analysis method to remove its weakness that was mainly created by its heavy dependence on the G/L analysis. It will be also necessary to expand spatial research sphere beyond Chungnam Province into the entire South Korean west coast region, and introduce a more comprehensive approach for suggestions over the issues of international value chain integration and regional logistics integration and inter-connection between South Korea and China.

## Acknowledgement

This study is based on a research project titled “Development Strategies for Chungcheong Region as the Center of the Pan Yellow Seam Region,” which was conducted and presented with supports from Bank of Korea and Chungnam Province in 2013.

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