Economic Relationship of China -Korea- Japan and Their Technological Cooperation in the IT industry

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Abstract

Regionalization is a part of globalization and a dynamic process of marching towards globalization. The so-called NADEs (Northeast Asia's Dynamic Economies) including Japan, Korea and China are expected to lead economic growth in the Asia-Pacific region. This paper analyzes the trade and investment relationships among the three countries, points out the necessity for their technological cooperation which may be helpful in the reconciliation of their chronic trade imbalance and frequent trade conflicts and support China-Korea-Japan FTA in the future, and suggests some strategic considerations for their strategic alliance in IT industry, in connection with Gerlach(1992), Dunning(1995, 1997), Hagedoorn(1993a and b, 1995), Duysters and Hagedoorn(1996), Santangelo(2000), etc.

JEL Classification : F02, F15, O14, O15, O32.

Keywords : globalization, regionalism, free trade agreement, technological cooperation, strategic alliance, STP(scientific technological partnership), IT(information technology), ICT(information communication technology), BPR(business process reengineering), ERP(enterprise resource planning).

< Contents >

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Ⅰ. Introduction

History is a mirror for seeing future. In the ancient history of China, Korea and Japan, all of which are origins of Oriental (especially East Asian) culture, the three countries had close relationships. Korea and Japan accepted new culture from China, which was respectively Koreanized and Japanized by each of them, creating Northeast Asian culture bloc. In the process, Korea played an important bridging role (Lee, 2002). In the modern times, invasion of Japanese imperialism during the World War II brought large historical scar to Korea and China. The Japanese fault casts shadow still on the heart of Korean, Chinese and other Asian peoples. After the World War II, ideological conflict drove China and the Korean Peninsula into a tragic internal strife (Lim, 1995).

In the cultural aspect, Northeast Asia stood at the heart of the ancient East Asian civilization bloc, and accepted the Western civilization fastest as well as showed highest development among the Eastern civilization covering the whole Asia-Pacific. In the future, Northeast Asia is expected to lead the creation of new culture in the process in which Eastern and Western ancient cultures fuse and integrate (Lim, 1999).

The author has asserted that the challenge of Asia in the 21st century is to form a Northeast Asian economic block comprising Korea, Japan, China's three northeastern provinces, and Russian Far East (Lim, 1996a and b, 1997, 1998, 1999, 2000, and 2001a). Such a Northeast Asian economic bloc[1] will be the largest conomic community in Asia in terms of area, population, and production, which is comparable with EU and North America.

The potential of regional cooperation of the three Northeast Asian countries (Korea, Japan and China) can be found in the dynamism of economic growth in this region. China has abundant natural resources and labor force while this country has less-developed technologies. Korea has middle technology and a good experience of economic development but little natural resources. Although Japan has high technology and abundant capital, this country is in need for stable acquisition of natural resources and skilled labor force and moves towards an ageing society so that shortage of labor force is urgent task which Japan has to solve now and in the future. If the aforementioned endowments are efficiently combined to promote the regional economic cooperation, the three countries could be much benefited from it and further lead the

[1] However, Northeast Asian economic block excludes Taiwan, Hong Kong, and Mongolia. Today, Northeast Asia has formed five economic blocs: ⅰ) East Sea Rim economic block covering the east coast of Korean Peninsula, Japanese Sea shore of Japan, and the Far East of China and Russia, ⅱ) West Sea Rim economic bloc connecting the West Sea of Korean Peninsula, Kyushu of Japan and the east area of China, ⅲ) Hwanan economic bloc covering the Guangdong Province of China, Hong Kong and Macao, ⅳ) Cross-strait economic block connecting the Fujian Province of China and Taiwan, and ⅴ) local economic blocs like the border economic bloc on the border between China and Russia.

remaining Asian countries. It is true that Japan, Korea and China have a large heterogeneity in terms of initial endowment of production factors as well as economic development stage. Such heterogeneity may rather provide a base for mutual complementary economic cooperation among the three countries[2].

Economic cooperation of Japan, Korea and China is significant in the aspect of the current socioeconomic situation of each country. Japan has been trying to escape from the prolonged recession of *Heisei*. Korea has been restructuring the basic framework of intensive economic development after the foreign exchange crisis in 1997 and 1998. China has incorporated into world economy by shifting from socialistic economic system to market economic system and participating to the WTO (November 10, 2001).

Basic concept in pushing forward with the idea of Northeast Asian economic bloc is the so-called 'wave' model. Following this model, the origin of 'wave', i.e. the starting point of Northeast Asian economic cooperation lies in the promotion of mutual complementary economic cooperation of Japan, Korea and China, all of which are called NADEs (Northeast Asia's Dynamic Economics). In connection with the idea of Northeast Asian economic bloc, the author would like to emphasize that the three countries need to expand industrial / technological cooperation, especially in the IT (information technology) industry, for the following reasons :

First, the three countries' industrial/technological cooperation can yield more and better performance in their trade and investment, avoiding mutually-harmful trade conflicts (e.g., anti-dumping issues) resulting from their fiercer competition due to the overlapping of their industries. In detail, economic development model of the so-called flying geese model of Japan, Korea and China has collapsed.[3] From the standpoint of this model, Japan, Korea and China, in order, experienced successful commercialization of new technologies, construction of mass-production system, and transfer of production base to foreign countries. Till the 1980s, industrial structure among the three countries took the form of the flying geese model under which Japan was followed by Korea and China, in order. In the 1990s, Japan made slow transition to new industry and delayed transfer of traditional industries to Korea and China. This leads the three countries to the overlapping of industry. Moreover, Korea and China have attracted IT and automobile industry due to each government's energetic policy support and attraction of foreign capital. As a result, the two countries' competition with Japan has become fierecer. For this reason, industrial development among the three countries gets

[2] This point has been formally emphasized by the Summit Meeting's common declaration on Korea-China-Japan FTA, on October 7, 2003.

[3] The flying geese model means that a late comer develops through import of new industry, domestic production, export, maturization, and reimportation. The model is marked 'flying geese model' or 'catching up product life cycle model'. This model was used to theorize the process of Japan's industrial catch-up and diversification : when industrialization is introduced from developed countries to an economy, it develops to the period of export growth via that of import substitution. This process proceeds with a time lag in each industry, taking in the form of geese flying in formation.

increasingly remoter from the flying geese model. At the same time, immature industries and even high-tech industries are being transferred from Japan and Korea to China. The Western firms including the US players accelerate the transfer of their industries and products through direct investments to China, regardless of the technological development stage, as Chinese market opening has been expanded through its accession to the WTO (November 10, 2001). Consequently, China's catch-up of Korea and Japan marches fast, and the three countries are further driven toward fiercer competition.

Second, the three countries' industrial/technological cooperation in the IT industry can accelerate the drive towards the regional economic bloc has been recently nowadays enhanced. Typical example is that NATFA and EU improve their regional competitiveness by building an open cooperative network in the two regions. EU[4] expands the scope of integration from economy to politics, and plans to win ten countries as new members, sooner or later, including the Eastern European countries. Launched the NAFTA in 1994, North America is going to finish all negotiations for FTAA (Free Trade Area of the Americas) directing at expanding its scope to Latin American countries by January 2005, and launch the FTAA in December 2005. This has stimulated the necessity and demand for enhancing Northeast Asian economic bloc which has grown to be matchable to NAFTA and EU in terms of the volume of trade and investment. In detail, in the world, 26 FTAs were signed by 1990, the figure skyrocketed to 255 by the end of 2002, more than 70 FTAs are currently under signing procedure. Meanwhile, in Asia, no FTA has been signed by the end of 2000. However, in 2001, Asian countries entered into a heated race for signing the FTA. For the past two years since 2001, 16 FTAs in Asia were signed, and 40 FTAs in the same region are currently being pushed forward. Japan is going to complete comprehensive negotiations for economic alliance with ASEAN, which covers FTA by 2012. China plans to sign an FTA with six countries including Singapore by 2010, and four countries including Vietnam by 2015.

The discussion on Korea-China-Japan FTA is an actual starting point for economic integration in Asia (Lim, 2001a, 2003d). Recently, the Summit Meeting of ASEAN[5] + 3 (Korea, China, and Japan) was held in Bali, Indonesia on October 7, 2003. The Korea-China-Japan Summit Meeting at the talks announced the first common declaration in history. The declaration has the following framework : (1) The three countries agreed to intensify economic cooperation covering trade and investment, push

[4] Historically, the predecessor of the EU is the EC, for which base was laid by Benelux Customers Union. It is known that prominent leaders like Jean Monnet, who is called as the father of EC integration, had dedicated to it.

[5] With ten member countries, ASEAN is a large market with 500 million population. It signed the 'Bali Pact', which aims at modeling after the EEC that the Western Europe took during 1960s and 1970s and building a single market by 2020.

forward joint efforts in environment, energy and resource development, and jointly study about their FTA ; and (2) Based on their cooperation for providing peaceful solution for North Korean nuclear issue[6], the three countries agreed to increase their joint efforts to develop multilateral cooperation in East Asia, and take political, diplomatic, and administrative actions including export control of WMD (Weapons of Mass Destruction) by strengthening their cooperation related with mutual arms reduction.[7]

Third, in the era of the so-called "alliance capitalism" (Gerlach, 1992 ; Dunning, 1995 and 1997), the corporates of the three countries need to persue their strategic technological partnerships(STPs)[8], as many firms in other regions do so,[9] in response to the growing technological interrelatedness and the need to acquire capabilities in related fields. In the 1980s, the increased adoption of STPs as a form of organization of economic activity has been identified as a main feature of a new phase of the capitalist system (Gerlach, 1992; Dunning, 1995 and 1997), where competitiveness is increasingly pursued through cooperation. The growth in the number of technology based inter-firm alliances has mainly been recorded in science-based fields such as ICT (Hagedoorn, 1993b; Hagedoorn and Schakenraad, 1992; Duysters and Hagedoorn, 1995).

Under the previously-mentioned background, the author would like to raise the following questions for the China-Korea-Japan case : how can the three countries pursue economic cooperation leading to their FTA for their better economic performance and sustainable development? What kind of economic cooperaton shall be needed for the three countries? If we choose strategic alliance on the IT industry, how could we implement it in an efficient way?

The purpose of this study is to analyze trade and investment relationships of China-Korea-Japan and suggest some strategic considerations for their strategic alliance on IT industry in an attempt to reconcile their chronic trade imbalance and frequent trade conflicts, thereby providing a foundation for their FTA in the future. For the above

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[6] The Korean Peninsula is a powder magazinem which can esplode any time. This was known enough in recent North Korean nuclear issue. It may be possible to construct and administer "*Northest Asian Peace City*" that the author has vindicated as an alternative for keeping prosperity and peace in Northeast Asia by a collective multilateral cooperation in Northeast Asia (Lim, 2001b).

[7] It should be noted that Korea-China-Japan summits promised to cooperate in export control of WMD. This can be regarded as a practical agreement based on the common recognition that a third party with 'undesirable' intention shall not be allowed to obtain North Korean nuclear warhead or related materials.

[8] For example, Hagedoorn(1993a) pointed out the rationale of strategic technology partnering, the same author(1993b) discussed strategic technology alliance and modes of cooperation in high-technology industries, and the same author(1995) also analyzed trends, networks and corporate patterns of noncore technologies during the 1980s. Duysters and Hagedoorn(1996) empirically investigated internationalization of corporate technology through strategic partnering.

[9] For example, Santangelo(2000) investigated the role of corporate technological specialization factors in the conclusion of STPs for the European ICT industry case by carrying out a dynamic analysis, and Georgliou(2001) analyzed evolving frameworks for European collaboration in research and technology.

purpose, Chapter Ⅱ analyzes trade structures and investment relationships among China, Korea and Japan. Chapter Ⅲ analyzes global trend in IT industry, general trend of ICT in Asian countries, and characteristics of China-Korea-Japan's strategic alliance in ICT, and proposes some schemes for expanding technological cooperation of the three countries in the IT industry. Finally, this study puts forward conclusive remarks in Chapter Ⅳ.

Ⅱ. Economic Relationships among China, Korea and Japan

1. Trade Relationships

A. Trade Structure of the Three Countries

Since late 1980s, the circumstances surrounding Northeast Asia showed a large change including successful reform and liberalization of China, end of the Cold War, and transition from GATT to WTO. These changes played a positive role in increasing trade among Japan, Korea and China.

China achieved high economic growth at annual average rate 10% in the 1990s. China's economic growth rates were 8.0% in 2000 and 7.3% in 2001. Especially, Chinese manufacturing industry grew fast each year at 8~10% during the last decade. To support high eonomic growth, China needs supply of many raw materials, electric and electronic parts, semiconductor and production facilities. By taking advantage of geographic closeness to the coastal areas of China, Korea has increased export to China with raw materials and parts (electric and electronic parts, semiconductor and chemical raw materials).

Current trade statistics show that the three countries have become major trade partners for each other. Korea's exports to China was just US $ 2,654 million in 1992, but it has increased about 9 times to US $ 23,754 million in 2002, and its imports to China recorded US $ 17,400 in the same year. Japan's exports and imports to China also have increased 2.5 times and 3.5 times, respectively, to US $ 4,980 and US $ 7,728 for the same period (1992~2002). As a result, in 2002, China was ranked as the second export market (next to the US market) for Korea, and the third source for Korea's imports after Japan and the US. In the same year, China also was ranked as the second export market (next to the US market) for Japan and the first source for Japan's imports. The three countries are within top 4 trading partners for each other. From the view-point of China, in 2002, Japan and Korea were respectively the third and fourih export markets whereas Japan and Korea were respectively the first and third sources for China's imports.

China's share of trade volumes of the three countries has rapidly increased, compared to the period before its diplomatic normalization with Korea in 1992 and Japan in 1995. China occupied 9.5% of Korea's total export in 2000, ranking as the 3rd market for Korea's exports. However, in 2002, China shared 14.6% of Korea's total export, ranking as the 2nd market for Korea's exports, overtaking Japan's share of Korea's total export. Meanwhile, China's share of Japan's total export was 5.58%, ranking as the 3rd market for Japan's exports in 2000, but it was increased to 9.6%, ranking as the 2nd market for Japan's exports in 2002. For China, Korea was the 4th source of its imports 2000, but then became the 3rd source after 2 years had passed.

As shown by Table 1, trade of manufactured goods among Japan, Korea and China has continued to the expansion of Korea-China trade and Japan-China trade due to China's economic growth and industrial development. China has increased the portion of manufactured goods in exporting to and importing from Korea and Japan. On the contrary, the portion of manufactured goods in Japan-Korea trade has shown a slight decline.[10]

Table 1. Portion of Manufactured Products Trade among Japan, Korea and China

(Unit: %)

		1991	1992	1994	1996	1998	2000	2002
Korea-China	Export	86.9	90.8	89.2	87.2	85.7	86.3	91.0
	Import	57.3	51.7	60.7	71.8	71.3	74.0	77.5
Korea-Japan	Export	80.5	78.9	81.6	74.2	75.2	72.4	74.0
	Import	95.6	95.7	96.0	95.8	95.3	95.6	94.9
Japan-China	Export	94.7	94.3	94.5	93.0	93.2	93.4	n.a
	Import	56.4	62.3	70.1	77.0	79.6	82.7	n.a

Note : Korea-China trade represents Korea's trade with China. Manufactured goods used in this table belongs to SITC 5~8 classifications. The portions of export is determined by each country's total amount of manufactured goods export divided by total export amount, while the portion of import is determined by each country's total amount of manufactured goods import divided by total amount of import.

Source : Korea International Trade Association (www.kotis.net) and Japan External Trade Organization (www.jetro.or.jp)

As shown by Figure 1, Korea exports raw materials such as chemical products and textiles (woven stuff) to China, and imports textile products and electronic parts (semiconductor) from China. Japan imports consumer goods from China, and exports

[10] While Japan and Korea have remained important trading partners each other since the diplomatic normalization in 1965, the bilateral trade has shown a downward trend in the 1990s due to Korea's industrial developments and trade diversification. Japan's share Korea's total export dropped from 19.4% in 1990 to 9.3% in 2002, and its share of Korea's total imports also declined from 26.6% in 1990 to 19.6% in 2002.

capital goods such as electronic parts (semiconductor) and chemical products (precision chemistry) to Korea, and capital goods and raw materials to China.

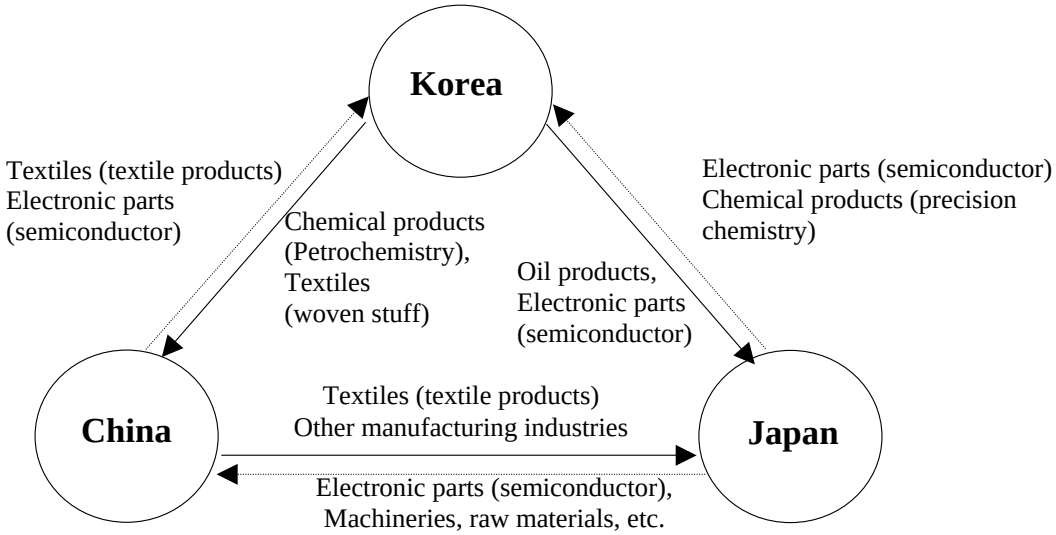


Fig. 1 Major Import and Export Products of Japan, Korea and China

Looking at the trade pattern between the three countries and the world, Korea and China import intermediary goods or capital goods mainly from Japan, Taiwan, and ASEAN. After processing and assembling them, the two countries (Korea and China) export the processed or assembled commodities primarily to Japan or East Asia, while they export final goods to USA, Europe, and Japan. Korea ranks top in terms of dependence of intermediary and final goods on the regional import and export, followed by China and Japan, in order.

It should be noted that the trade structures of Japan, Korea and China are very similar. Their largest export market is USA. Top 5 trading countries of USA involve the three countries followed by Southeast Asian countries including Taiwan and Hong Kong. Trade with European countries as percentage of the whole trade of the three countries is relatively low. Japan, Korea and China show, respectively, a high concentration on their trade with top 10 trading countries. Especially, China's export and import concentration on the top 10 trading countries are 76.4% and 74.4%, respectively, which show no diversification in import and export market.

As shown by Table 2, a comparative view on the trade balance among the three countries during the time-period of 1990~2002(except the period before and after the Asian financial crisis in 1998) shows a very interesting phenomenon that Korea has continued to record surplus in trade with China, with China's surplus in trade with Japan and Japan's surplus in trade with Korea. Since 1993, Korea has been the major source of China's trade deficit, recording as the largest source of China's trade,

particularly in 2001 and 2002 in succession. The deficit has increased almost 9 times for last 10 years from 740 million U$ in 1993 to 6,534 million U$ in 2002. As Korea has been the largest source of China's trade deficit since 1993. Japan has been the largest source of Korea's trade deficit since the diplomatic normalization in 1965.

Table 2. Trade balance among Japan, Korea and China

(Unit: USD 100 mil., Current price)

Year	Balance of Korea's Trade with China	Balance of China's Trade with Japan	Balance of Japan's Trade with Korea
1990	-10.84	58.82	59.36
1992	-10.71	50.09	78.59
1994	7.40	88.28	118.67
1996	28.38	185.49	156.82
1998	54.60	170.02	46.02
2000	56.56	249.30	113.62
2002	63.54	218.00	133.50

Source : Same as in Table 1.

Examining trade structure of China-Korea-Japan in terms of the adjusted GL index ($\hat{GL}$),[11] we obtains the following results (see Table 3) :

First, horizontal intra-industry trade index has continuously increased in Japan-Korea, Japan-China, and Korea-China trade for the most of relevant years during the time period (1990~2002). Although Japan has suffered from economic slump for a long time, Korea and China have shown a relatively high economic growth, increasing their per capita income and market size. This empirical finding is consistent with the traditional theory of intra-industry trade (for example Aturupane, Djankov, and Hoekman, 1999).

Second, the horizontal intra-industry trade index between Japan and Korea was highest for the most of relevant years in the same period, followed by the Korea-China trade index and the Japan-China trade index, in order. The inter-industry trade index has a relatively low portion in Japan-China trade since a large difference exists in factor endowment in the two countries and their industries stay in a quite different development stage. In contrast, in case of Korea-China trade, the horizontal

[11] When the calculated index of intra-industry trade is $0.75 \leq$(export unit price / import unit price)≤ 1.25 in an industry, a trade in a given industry is considered as horizontal intra-industry trade whereas the calculated index is out of the range above, it is considered as vertical intra-industry trade.(Aquino, 1981 ; Greenaway et al., 1994) The adjusted GL index ($\hat{GL}$) is calculated as follows :

$$\hat{GL} = \left[\frac{\sum_{i=1}^{n}(X_i + M_i) - \sum_{i=1}^{n}|X_i - M_i|}{\sum_{i=1}^{n}(X_i + M_i) - \left|\sum_{i=1}^{n}(X_i - M_i)\right|} \right] \times 100 = \overline{GL} \times \frac{1}{1-k} \quad \text{where} \quad k = \left[\frac{\left|\sum_{i=1}^{n}(X_i - M_i)\right|}{\sum_{i=1}^{n}(X_i + M_i)} \right]$$

intra-industry trade has a relatively high portion since a small difference in factor endowment exists low in the two countries and their industrial development stage is relatively closer.

Third, the vertical intra-industry trade (which is a trade between the commodities showing a large difference in price, technology, and quality) has a relatively low portion of total intra-industry trade in Korea-Japan, Japan-China, and Korea-China. Especially, trade between Japan and China is remarkable. The vertical intra-industry trade has a relatively low portion in Japan-China trade because a large difference in factor endowment exists in the two countries.

Fourth, since the second half of 1990s, the portion of vertical intra-industry trade of total intra-industry trade has declined in Korea-Japan, Japan-China, and Korea-China. Considering that its portion showed no such a big change in the same period, the portion of the horizontal intra-industry trade of total intra-industry trade might have been relatively increased since the second half of 1990s. Consequently, it is expected that trade among the three countries will lay stress on the differences in function and design of exporting commodities in the future.

Table 3. Intra-industry trade index of the three countries

Year \ $\hat{GL}$	Adjusted GL index ($\hat{GL}$) of 'horizontal' intra-industry trade			Adjusted GL index ($\hat{GL}$) of 'vertical' intra-industry trade		
	Japan-Korea	Japan-China	Korea-China	Japan-Korea	Japan-China	Korea-China
1990	40.12	15.01	17.14	32.29	11.79	8.89
1991	37.21	16.56	23.35	25.69	12.69	11.67
1992	37.61	14.30	13.74	29.69	9.81	7.83
1993	39.83	12.82	17.84	30.72	11.92	15.27
1994	47.16	17.71	24.69	34.79	15.89	18.39
1995	50.50	24.28	30.52	36.85	18.31	21.82
1996	51.53	28.72	32.49	43.09	23.74	21.20
1997	54.37	32.11	30.33	42.85	29.70	20.83
1998	48.29	32.89	33.76	41.95	29.00	25.31
1999	47.67	33.30	37.19	40.09	30.60	24.12
2000	48.13	34.12	38.21	38.96	28.87	29.97
2001	50.56	33.21	38.66	34.13	24.87	25.53
2002	54.10	29.73	36.26	33.72	23.41	24.12

Source : Same as in Table 1.

Examining export-based complementary relationship of the three countries for the two years : 1997 and 2001, China-Japan's export coupling is estimated to have been higher than Korea-Japan's (see Table 4). That is, China stands higher above Korea in terms of export coupling with Japanese market. Korea's export coupling with China is higher

than Japan's export coupling with China. This suggests that Korea standed above Japan in terms of export-based complementary relationship with Chinese market.

Table 4. Export coupling among Japan, Korea and China

year / Export Coupling[1)]	1997	2001
Japan's export coupling with Korea	1.85	1.86
Japan's export coupling with China	1.99	1.79
Korea's export coupling with China	2.90	2.23
Korea's export coupling with Japan	1.29	1.44
China's export coupling with Korea	1.55	1.49
China's export coupling with Japan	2.14	2.08

Note : 1) Export coupling per country of the country i: (the country i's trade with each country /the country i's total trade)/(trade of each country /world total trade)
Source: Korea Trade Association, KOTIS D/B.
Ministry of Finance of Japan, Annual Statistics of Finance and Economy, various issues.

B. Structure of Korea-Japan Trade

As shown by Table 5, in 2002, Korea's major items exporting to Japan included electrical machinery, apparatus, appliances (SITC 77), office machines, automatic data processing machines (SITC 75), and petroleum, petroleum products and related materials (SITC 33). These products of the three industrial sectors occupied 38.1% of Korea's total exports to Japan in the same year.

Table 5. Korea's Top 5 Exporting Items to Japan (2002)

(Unit : US $ million)

Rank	SITC	Korea's Exporting Items to Japan	Volume	Share (%)
1	77	Electrical machinery, apparatus, appliances	3,067	20.3
2	75	Office machines, automatic data processing machines	1,380	9.1
3	33	Petroleum, petroleum products and related materials	1,319	8.7
4	99	Commodities, transactions not classified	1,088	7.2
5	76	Telecommunication, sound recording apparatus	789	5.2
Subtotal			7.644	50.5
Total amounts			15.143	100.0

Source : KOTIS (Korea Trade Information Services) *Trade Statistics*.

Meanwhile, as shown by Table 6, Korea's imports from Japan in 2002 were electrical machinery, apparatus, appliances (SITC 77), of which share of Korea's total imports from Japan being about 23.6%, followed by iron and steel (10.7%) and machinery (SITCs 72 and 74). The three items occupied more than 40% of Korea's total imports from Japan in the same year, which were mainly concentrated on high-end intermediate goods and capital goods, reflecting the close industrial linkages between the two countries.

Table 6. Korea's Top 5 Importing Items from Japan (2002)

(Unit : US $ million)

Rank	SITC	Korea's Importing Items from Japan	Volume	Share (%)
1	77	Electrical machinery, apparatus, appliances	7,044	23.6
2	67	Iron and Steel	3,180	10.7
3	72	Machinery specialized for particular industries	1,794	6.0
4	74	General industrial machinery and apparatus	1,596	5.3
5	76	Telecommunication, sound recording apparatus	1,506	5.0
		Subtotal	15,120	50.6
		Total amounts	29,856	100.0

Source : Same as in Table 5.

Comparative analysis on the distribution of top 40 items in the RCAI (Revealed Comparative Advantage Index)[12] per item of Korean and Japanese products in the category of SITC 3 shows that both Korea and Japan have strong comparative advantage in synthetic fiber, artificial resin, plastic materials, ship, record player, recorder, heat ion device, and electric and electronic devices. Also, comparison of the RCA indices of top 50 exporting commodities of both countries in the category of SITC 4 shows that Korea and Japan have the same indices in 21 commodities, and seven of top 20 commodities have same indices. Especially, Korea's top and second-place exporting commodities match to Japan's top and second exporting commodities in the category of SITC 7 (industrial machinery, automobile, electronics, etc.).

Consequently, Korea has increased competitive products in the fields where Japan has enjoyed comparative advantage. This shows that competition between Korea and Japan has become fiercer. From the standpoint of industry type, both countries have comparative advantage. However, from the standpoint of subdivision of items and products, Korea has comparative advantage in universal and standardized products, and Japan enjoys comparative advantage in noncompeting differentiated products. And, competing differentiated-products located in-between are in the competing relationship between the two countries.

C. Structure of Korea-China Trade

As shown by Tables 7 and 8, the items showing the largest trade volume are electrical

[12] RCA proposed by B. Balassa (1982) can be represented by using export performance ratio (EPR: $X_{ij}/X_{wj}/X_i/X_w$). This ratio expresses the share of the country i's export of commodity j in total world export of commodity j, as a ratio of the country i's total in the world exports. If the EPR is higher than 1, the country i's commodity j has comparative advantage. RCA is defined by the formula below :

$RCA = \frac{X_{ijk}}{X_{jk}} / \frac{X_{ik}}{X_k}$ where X_{ijk} : the country i's export of commodity j to the market k, X_{ik} : total import of commodity j to the market k, X_{jk} : total export of the country i to the market k, and X_k : total import of the market k.

machinery, apparatus, and appliance (SITC 77), their share of Korea's exports to China and Korea's imports from China in 2002 being 12.7% and 15.6%, respectively. Such a trade concentration on the limited items reflects their competition among Korean and Chinese products and the strong intra-industry trade between Korea and China.

Table 7. Korea's Top 5 Exporting Items to China (2002)

(Unit : US $, million, %)

Rank	SITC	Korea's Exporting Items to China	Volume	Share (%)
1	77	Electrical machinery, apparatus, appliances	3,028	12.7
2	76	Telecommunication, sound recording apparatus	2,992	12.6
3	51	Organic chemical	2,295	9.7
4	65	Textile yarn, fabrics, made-up articles	1,985	8.4
5	75	Office machines, automatic data processing machines	1,909	8.0
		Subtotal	12,209	51.4
		Total amounts	23,754	100.0

Source : Same as in Table 5.

Table 8. Korea's Top 5 Importing Items from China (2002)

(Unit : US $, million, %)

Rank	SITC	Korea's Importing Items from China	Volume	Share (%)
1	77	Electrical machinery, apparatus, appliances	2,723	15.6
2	84	Articles of apparel and clothing accessories	1,709	9.8
3	65	Textile yarn, fabrics, made-up articles	1,095	6.3
4	75	Office machines, automatic data processing machines	1,081	6.2
5	76	Telecommunication, sound recording apparatus	1,025	5.9
		Subtotal	7,633	43.9
		Total amounts	17,400	100.0

Source : Same as in Table 5.

Korea's major items exporting to China include not only electrical machinery, apparatus, appliances (SITC 77) but also telecommunication, sound recording apparatus (SITC 76), organic chemical (SITC 51), textile yarn, fabrics, made-up article (SITC 65), and offices machines, automatic data processing machines (SITC 75). The industrial sectors above occupy 51.4% of Korea's total exports to China in 2002.

Meanwhile, Korea's major items importing from China are electrical machinery, apparatus, appliances (SITC 77), of which share being about 15.6% of Korea's total imports from China, followed by apparel and clothing accessories (9.8%), textile yarn, fabrics, made-up articles (6.3%), office machines, automatic data processing machine (6.2%), and telecommunication, sound recording apparatus (5.9%). The industrial sectors above occupy 43.9% of Korea's total imports from China in 2002.

2. Investment Relationships

Overseas direct investment (hereinafter ODI) between the three countries looks

somewhat unbalanced. As shown by Table 9, China is the 2nd largest partner of Korea for total ODI, as of June 2003. Korea's ODI to China reached US $ 6,673 million, 16.3% of Korea's total ODI, whereas its ODI to Japan recorded US $ 716 million, merely 1.8% of Korea's total ODI.

Table 9. Korea's ODI to China and Japan

(Unit : US $ million)

	1992	1994	1996	1998	2000	2002	Total
Korea's ODI to China[1)]	141	633	901	678	612	888	6,673
Share[1)] (%)	11.6	27.5	20.4	14.4	12.6	29.3	16.3
Korea's ODI to Japan	28	58	81	23	92	76	716
Share (%)	2.3	2.5	1.8	0.5	1.9	2.5	1.8

Note : 1) Korea's total ODI to China.
2) Share in Korea's total ODI to world.
Source : Korea Export and Import Bank.

In contrast, as shown by Table 10, China is the 17th for total inflow of foreign direct investment (hereinafter FDI) to Korea with the share of 0.56% only. However, FDI from China has increased very rapidly. If we take account of the FDI in 2002 only, Chinese direct investment was ranked as the 6th largest for annual inflow of FDI to Korea, its share being 2.74%.

Table 10. Japan and China's FDI to Korea

(Unit : US $ million)

FDI / Country	2001		2002		1962~June 2003	
	FDI	Rank	FDI	Rank	FDI	Rank
US	3,889	1	4,500	1	26,880	1
Japan	772	5	1,403	2	13,081	2
Netherlands	1,245	3	451	3	10,422	3
Malaysia	785	4	210	8	6,188	4
German	459	6	284	4	5,250	5
France	426	8	111	11	3,216	6
Canada	1,506	2	261	5	2,933	7
Singapore	190	11	146	9	2,708	8
UK	432	7	115	10	2,392	9
Hong Kong	167	13	234	7	1,772	10
Cayman Islands	20	17	43	13	1,693	11
Bermuda	57	16	6	17	1,586	12
Island	174	12	23	15	1,388	13
Belgium	201	10	73	12	1,214	14
Taiwan	314	9	9	16	709	15
Virgin Island	81	14	31	14	614	16
China	70	15	249	6	498	17
Total FDI to Korea	11,292		9,101		82,544	

Source : Same as in Table 9.

Examining the investment relationship between Japan and Korea, Japan was the 11th among the ODI countries invested by Korea, and the 2nd largest investor to Korea after the US, as of June 2003. From the viewpoint of Japan, Korea ranks the 7th among the ODI countries that have invested by Japan and the 16th among the FDI countries that have invested to Japan, respectively. The portion of Korea's direct investment to Japan still remains low, accounting for 1.9% of Korea's total ODI in 2000 and 2.5% of the same ODI in 2002. Korea's ODI in Japan is primarily concentrated on the wholesale and retail, real estate, and service industries.

Meanwhile, Japan's direct investments to Korea sharply decreased from 1995 because of weaken competitiveness, economic crisis, etc. But, as Korean economy had recovered from the crisis, Japan's direct investments to Korea rebounded again after 1998. Then, Japan's share made up with 15.4% of Korea's total inflow FDI in 2002, amounting to US $ 1,403 million. Until the 1980s, Japan's direct investment to Korea focused on the manufacturing sector for such products as textiles, apparel, electricity and electronics, metals, and machinery, in an attempt for Japanese companies to relocate the less-competitive manufacturing sectors overseas. However, along with growing of the Korean market as well as rising wages in the 1990s, Japan's direct investments to Korea have been rapidly shifting from the manufacturing sector to the service industry, as the same pattern can be found from Korea's direct investments to China.

On the other hand, Korea's investment in China skyrocketed after the establishment of diplomatic relation between Korea and China in August 1992. During 1990s, there was a rush of direct investments to China among Korean companies, and most of them concentrated on manufacturing sector, especially on textile, apparel, electronic, electronic equipment and component, or so. According to the Chinese government's statistics, Korea's investment in China as percentage of total foreign investment in China was 3.1% in 2001, ranking the 7th place. More than 80% of Korea's ODI to China was concentrated on manufacturing sector by 2002. It may imply that Korean companies' ODI to China is still motivated by lower labor cost of Chinese manpower.

The reason why Korea's investment in China showed rapid growth within a short period in the mid-1990s was that Korea's labor-intensive export industry (garments, shoes and electronic parts), which lost competitiveness in export market due to domestic wage rise, moved production base to China in order to use the advantage of low wage. Korea's direct investment in China is characterized by investment led by small-and medium-sized companies in terms of investment subject, investment for saving production cost in terms of investment purpose, and investment primarily in the Bohai Gulf Rim including Shandong Province in terms of investment area.

Unlike ODI in other regions, Korea's direct investment to China is led by

manufacturing industry. Based on 2001, manufacturing industry, including garments, textiles, chemicals and electric and electronic products, as percentage of Korea's investment in China was 83.9%.[13] The investment is dominated by the investment in manufacturing industry for export to third countries, which covers textiles, garments, electric and electronic products, assembly metals, shoes and leathers using cheap labor force. However, Korean firms' investment in Chinese non-manufacturinh industries like construction, transportation and storage, and trade has recently increased.

Since China's accession to the WTO (November 10, 2001), the country has applied native treatment to the foreign companies invested in China, and opened gradually investment in service industry including financial market. Chinese government lifted the obligations of exporting products using China-made parts and equipoising balance of exchange, all of which had been imposed upon foreign capital invested companies. As service sectors like communication, distribution and tourism are opened gradually and additionally, investment in these industries increases. Consequently, a new momentum was imparted to Korean direct investment in China. Indeed, Korean firms' investment in China has shown definite recovery after China's accession to the WTO was decided in 2001, with the autonomy and stability in investment in China.[14]

Meanwhile, the investment complementarity relationship of the three contries can be measured in terms of investment coupling for the two years : 1997 and 2001(see Table 11). Japan's investment coupling with Korea was much higher than Japan's investment coupling with China. This suggests that investment-based complementary relationship between Japan and Korea was higher than the relationship between Japan and China.

Table 11. Investment coupling among Japan, Korea and China

year / Investment Coupling[1)]	1997	2001
Japan's investment coupling with Korea	1.32	3.21
Japan's investment coupling with China	0.43	0.96
Korea's investment coupling with China	1.75	3.00
Korea's investment coupling with Japan	-	-
China's investment coupling with Korea	-	-
China's investment coupling with Japan	-	-

Note : 1) Investment coupling per country of i country: (overseas investment per country of the country i/total overseas investment of the country i)/(foreign investment in each country /world total foreign investment)

Source: Korea Trade Association, KOTIS D/B.
Ministry of Finance of Japan, Annual Statistics of Finance and Economy, various issues.

[13] Manufacturing industry as percentage in the Korea's overseas investment is only 50%.

[14] It should be noted that improved conditions for foreign capital investment in China are helpful for Korean firms' investment in China but, from the global standpoint, Korea and China are in heated race over attraction of more foreign capital. For details, see Lim(2003c).

Ⅲ. Technological Cooperation in IT Industry among China, Korea and Japan

1. The Necessity

First of all, the author would like to point out the necessity for technological cooperation in IT industry among Japan, Korea and China under the following reasons :

First, from the preceding analysis, it should be noted that trade among the three countries during the time period of 1990~2002 showed a very interesting tail-to-tail structure of chronic trade imbalance, in which Korea has continued to record surplus in trade with China, with China's continued surplus in trade with Japan, and Japan's continued surplus in trade with Korea. Korea's huge trade surplus with China might be an important reason for China to have brought the anti-dumping issues. In contrast, Korea has continued to record chronic trade deficit with Japan since the diplomatic normalization in 1965.

Second, the trade structure between Japan and Korea is limited to a few selected commodities such as machinery, and electric and electronic products(see Tables 5 and 6). The trade structure between Korea and China is also limited to a few selected commodities (see Tables 7 and 8). Such a concentration on the limited items reflects the strong intra-industry trade structure between the two concerned countries. At the same time, the export concentration on a few selected commodities has brought out frequent trade conflicts (e.g. the trade dispute on garlic in June 2000). Korea has so often confronted with fastidious non-tariff barriers (hereinafter NTBs) in China, for example, anti-dumping or embargo for major exporting goods.[15] From 1997 to 2002, China brought 18 cases of anti-dumping issues before the courts. Korea was related to 14 cases of the issues, and became the most frequently appealed country followed by Japan's 9 cases and the US's 7 cases. In addition, Korea's major items exporting to China had been concentrated on the less-competitive industrial sectors of China, including petrochemical, iron and steel before 2001. These industrial sectors consist of Chinese national enterprises, which are mostly less competitive in the world markets. Therefore, Chinese government tried to protect domestic companies by using various NTBs. We

[15] In analyzing the structural change in the Korean commodities exported to China, special attention should be paid to the following characteristic. Majority of Korean products exported to China have increased their dependence on Chinese market, and designated as primary targets of Chinese import restrictions. In 2001, Korean export articles with high dependence on Chinese market were organic chemical products (43.8% of total export), leather and leather products (42% of total export), pyrotechnic products (31.5% of total export), shoes (31.3% of total export), and plastics (29.2% of total export). Among them, pyrotechnic products and organic chemical products are targets of anti-dumping case by China. For details, see Lim (2003c).

can expect that such a Chinese policy would be kept for a while even though China entered into WTO.

How can we solve the chronic trade imbalance and the trade conflicts among the three countries? The author believes that industrial/technological cooperation on IT in connection with intra-industry trade (rather than vague economic cooperation) can be a good solution to the aforementioned problem, either actual or potential, now and in the future. The author suggested some recommendations for technological coopeation between Korea and Japan in an attempt to reduce Korea's chronic trade deficit with Japan in his studies(1994, 2004a) and for the same cooperation between Korea and China in an attempt to resolve their trade disputes in his studies(2000, 2002, 2003a, 2003b, 2004b). However, such attempts are confined to the bilateral economic relationship, not for the tripartite relationship.

The rationale for the author's position on technological cooperation in IT industry leading to mutual prosperity and stability is based on a great deal of empirical work on the importance of national or industry technological attributes and their link to trade patterns or performance, asserted by for example Walker (1979), Balassa (1979), Pavitt and Soete (1980), Soete (1981), Le (1987), Grupp (1991), Dosi et al. (1990) and Danniels(1977). However, This study on the three countries' technological cooperation is confined to their regional cooperation on IT, not covering globalization of general S&T, research, or specific innovation.[16]

2. Strategic Considerations for Technological Cooperation

International industrial / technological cooperation can be motivated by distribution of risk and financial burden, acquirement of market entry path and market expansion, acquirement and transfer of technology, supplementary sharing and combination of competitive assets unique to enterprises, economies of scale, and prevention of excessive competition and improvement of business success possibility. The types of international industrial / technological cooperation can be divided into five: capital cooperation, production cooperation, marketing cooperation, technology cooperation, and R&D cooperation (Lim 2003a, b, c and d)

Particularly technology cooperation includes technology grant agreement, mutual

[16] Georghiou(1998) discussed global cooperation in research for the European case(particularly EUREKA). Archibugi and Pietrobelli(2003) presented an extensive and intensive research on a taxonomy of the globalization of technology including the international exploitation of nationally produced technology, the global generation of innovation and global technological collaboration. They also illustrated some evidences to support each of the preceding categories and suggested policy implications for each of them.

technology grant agreement, technology sharing agreement, technology support agreement, second sourcing, technology trade, etc. Technology cooperation is divided into two : vertical cooperation and horizontal cooperation, depending on cooperation contents. The former is mainly used for acquiring technical competency of cooperation partner. It can be illustrated by cooperation in scientific equipment for development of superconductor, home appliances, electric motors and electronic parts. The latter is made primarily for market access. It can be illustrated by cooperation in broadcasting, electronic parts and electronic industry for developing HDTV.

In particular, the term ‘strategic alliance’(sometimes also known as ‘corporate partnering’)[17] is used broadly to encompass the panoply of cooperative arrangements between different business firms created for more than individual transactions. For example, Gutterman(1995) explicitly includes minority investments, joint ventures, acquisition, and even long-term contracts within this concept of strategic alliances. He believes that strategic alliances are made in recognition of the contemporary intensification of specialization, and they permit managers to respond to competitive opportunities quickly and “without the need to incur the substantial risks associated with internal development”. He points that commercialization of new products and technologies usually requires skills and resources of a scope seldom found within any firm ; therefore, the commercializing firm needs to gain access to complementary assets and resources of other firms.

Duysters and Hagedoorn(1996) explored some trends in the internationalization of corporate R&D efforts, innovation output and strategic technology partnering in the past decade. Inter-firm strategic technology partnering, through which companies share their innovation efforts, supplements the standard indicators of technological competence to broaden the scope from internal innovation processes to a wider range of innovative activities. Their main conclusion is that, even in a 'global' industry such as information technology, internationalization of innovation, although by no means insignificant, appears less important than expected.

An explanation for 'regionalized' patterns of internationalization of both internal innovative efforts and joint R&D through strategic alliances can be found in the organizational complexities that surround these particular aspects of company organization and corporate strategies. The international coordination of production, servicing, sales and marketing already creates substantial organizational complexity for companies operating beyond their domestic markets. The internationalization of corporate R&D and other innovative activities, such as product development, with companies attempting to benefit from the internationally uneven distribution of

[17] See Hagedoorn(1993 a and b, 1995), Duysters and Haegodoorn(1996), Santngelo(2000) for example.

technological capabilities through an innovative presence beyond their domestic markets, creates additional aspects of complexity in international strategies and company organization. This organizational complexity and the risk of organizational failure probably explains why international inter-firm R&D collaboration is still of a strong regional nature, i.e. to a large extent concentrated within each of the major trading blocs, and why the internationalization of corporate innovation is, although by no means insignificant, still quite moderate. It appears quite rational that many firms limit themselves to a more internationally regional strategy with only moderate extension beyond their region of origin. That particular option largely coincides with an international strategy that represents a compromise between a domestic and a global strategy with still sufficient scale effects and ample opportunities for capitalizing on regionally available technological competences.

Therefore, we can know that international technological cooperation needs to be elaborated in terms of target technology, target country or institutes, methods or means, negotiation power, etc. Lim (2003a, b and c) suggested some strategic considerations for international industrial / technological cooperation are given to the three factors : (1) Needs (which technology is needed at the time?), (2) Resources (which resources are necessary for digesting and improving imported technologies?), and (3) System (which institutional mechanism is necessary for making, organizing, using and developing state-led technology cooperation policy?).[18]

Table 12. Strategic Considerations for Technological Cooperation

Factors	Description
Who	· Which roles will government and private sector play in S&T? Which institute should we cooperate with?
What	· Which group of technology should be subject to primary cooperation?
How	· How should we make portfolio of collaboration methods?
When	· Which stage of technology development activities should we collaborate at in terms of technology life cycle?
Where	· Where should we perform technology cooperation?
Why	· Which effects are expected from technology cooperation?

Source : Lim (2003a), p 299.

Archibugia and Pietrobelli(2003) presented a taxonomy of the globalization of technology with some evidences on global technological and scientific collaborations and summarized strategies for developing countries to access and use international know-how(see Table 13).

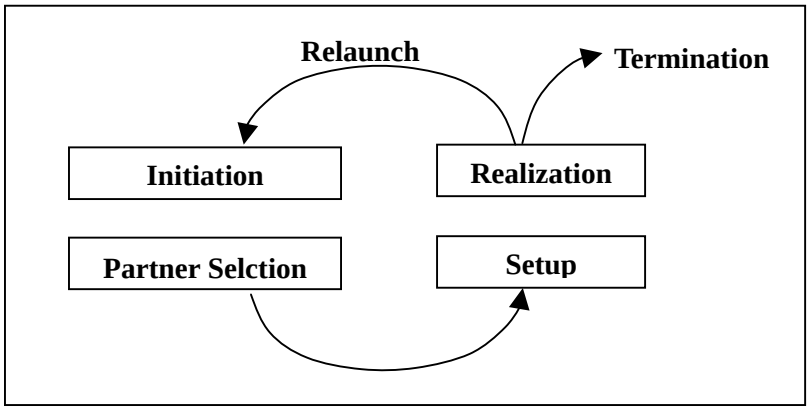
[18] For more details on the concepts, motivations, target fields, types and general theories of international industry-technology cooperation, see Chapter 8 in Lim (1997).

Table 13. Strategies for developing countries to access and use international know-how

Categories	Targets	Instruments
International exploitation of national innovations	· Achieve lower foreign dependency and fill technology gaps · Increase learning relevant to national industry · Obtaining competitive supply prices of technology-intensive products · Obtaining IPRs at fair conditions	· Promoting collaborations between national firms and leading firms in the field. · Incentives to selected FDI in the country and to their learning- enhancing modes of operation. · Negotiations on imports with foreign firms. · Multilateral agreements on IPRs and licences.
Global generation of innovations by TNCs	· Use TNCs to enhance national technological capabilities · Benefit from local technological activities of TNCs · Disseminate TNCs expertise locally	· Providing real incentives to the location of new innovative activities with foreign capital. · Upgrading S&T infrastructures and institutions. · Supply qualified workforce. · Monitoring the technological strategies and location choices of TNCs. · Associate TNCs centers to hubs of specific knowledge and industrial firms located in developing countries.
Global techno-scientific collaborations	· Use the foreign academic community to upgrade the scientific competence of the nation · Allow the country to become a junction of technical and industrial information · Apply knowledge to production	· Scientific exchange programmes. · Student flows to developed countries. · Incentives to international scientific projects. · Participation to international S&T organizations. · Developing infrastructures for techno-collaborations (scientific parks, consortia, etc.). · Promoting University/industry linkages and their international reach. · Participating to international organizations for technical and industrial collaborations.

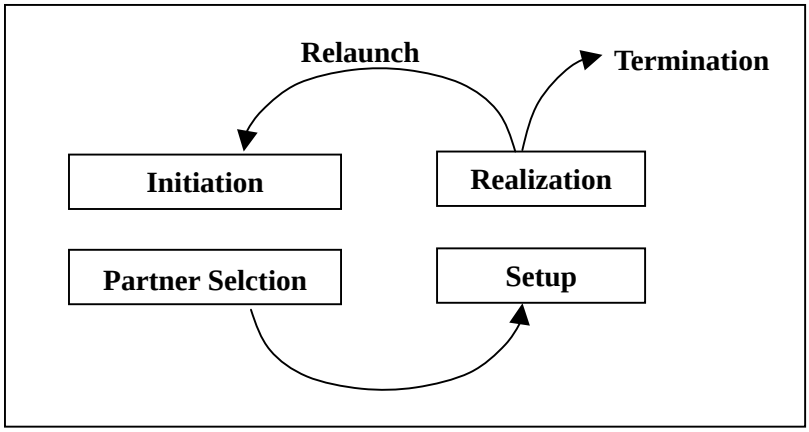
Source : adapted from Archibugia and Pietrobelli(2003).

Marxt and Link(2002) discussed the success factors of cooperative ventures in innovation and production systems with respect to structure, culture and risk.



Source : Adapted from Marxt and Link(2002).

Fig. 2 The cooperation process



Source : Same as in Fig. 2.

Fig. 3 The partner selection phase

Fig. 4 shows that the management of an interfirm cooperation in innovation and production systems is highly complex. Therefore, the manager needs a systematic approach to handle a cooperative venture such as the one described above. Besides this, a management concept for cooperation, the capabilities and the enthusiasm of the manager himself are of great importance.

	Structure	Culture	Risk
Initiation	· Detailed SWOT-analysis · Clear strategic definition · Realistic and clearly defined goals and objectives of the project	· Development of a cooperation culture · Experience in cooperative venture · Positive attitude	· Risk dialog · Risk awareness · Willingness to bear and share risk · Project risk analysis
Partner Selction	· Required profile · Strategic fit · Equality of all parties · Similar structure · Past experience	· Cultural compatibility · Similar values · Commitment to partnership · Trust, openness & honesty · Confidence in capabilities	· Partner's readiness for risk and information sharing · Similar premises of security and risk · Partner risk analysis
Setup	· Win-win-situation · Detailed project goals · Gfoals agreed by all parties · Initial collaboration agreement	· Information transfer from top management · Buildup of trust · Bridge the cultural differences	· Mutual benefits and interdependence · Joint Project risk analysis · Formalized risk/reward sharing agreement
Realization	· Accountabilities, ground rules and responsibilities · Experience & social skills · Effective controlling · Collaboration champion	· Commitment of top management · Communication frequency · Creat team spirit · Efficient conflict solving	· Systematic risk management · Project controlling to identify risks · Avoid outlearning
Termination	· Analyze and development of the cooperation as a whole · Project-to-project know-how- transfer	· Establish good interpersonal relationship · Willingness to develop the cooperation	· Learning about risk and project failure or success

Cooperation Success

Source : Adapted from Marxt and Link(2002).

Fig. 4 Main success factors

Meanwhile, Lal(1999) measured the intensity of adoption of IT in electrical and electronic goods manufacturing firms in India and identifies its determinants. He argues the degree of IT adoption will be determined by the variables such as entrepreneurship, skill intensity, government policy, openness of economy, competitive environment, and other firm-specific factors. He estimated that the qualification and information base of entrepreneurs and their attitude towards innovative activities and market share are significant determinants of the degree adiption.

3. Global Trend in IT Industry

It is generally known that digital economy has come. Today's digital network era requires standardization, modularization, open architecture, release of value chain, and outsourcing as key factors for improving industrial competitiveness, due to the eliminated inter-industry demarcation and the limited ability of individual firm to deal with ever-changing market conditions and technology.

Gunasekaran and Nath(1997) discussed the role of the IT function(e.g., Internet, Multimedia, EDI, CAD/CAM, ISDN) and the technologies themselves(e.g., CD-Rom, ATM, fibre optics) in BPR(business process reengineering) in connection with flexible, team-oriented, and cross-functionally co-ordinated management. Figure 5 shows their conceptual model to illustrate the role of IT in BPR.

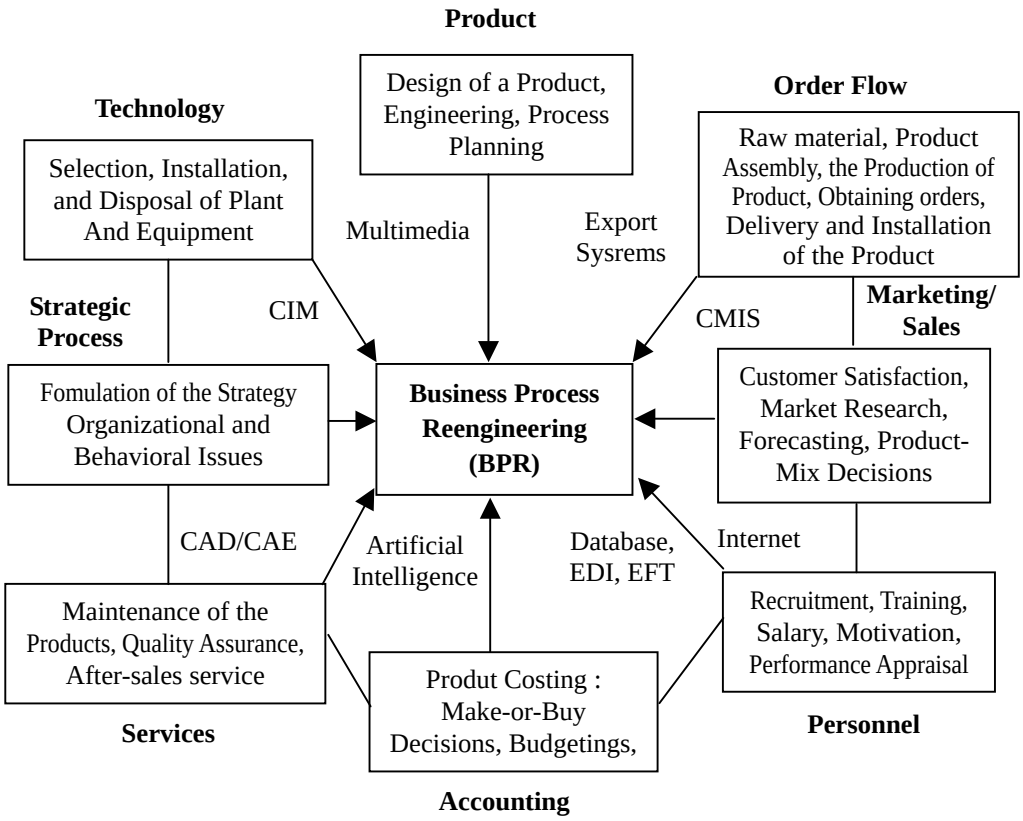


Fig. 5 A conceptual model to illustrate the role of IT in BPR

Miozzo and Soete(2001) analyzed the effects of IT on business organization, market structure, and internationalization in technology-intensive services(financial serveices, insurance, telecommunications, software computing and electronic information services, advertising, and accounting and management consulting), by using the data of Danniels and Moulaert(1991).

ICT is called as a synonym for the digital network era. ICT can be divided into telecom service, communication equipment, computer, internet, and software. Gunasekaran and McGaughey(2002) surveyed general trend of ICT(information and communication technology) in particular[19] and concluded as follows :

(1) Primary technologies of telecom service comprises traditional fixed-line technologies and wireless mobile communication technologies which have shown rapid growth in recent times. Wireless mobile communication technologies include CDMA, GSM, IMT 2000, and WAP application technologies enabling wireless internet service.

(2) Primary technologies of communication equipment include the technologies of designing and manufacturing fixed-line telephone, electronic switch, mobile handset and mobile communication station.

(3) Primary technologies of computer include the technologies of designing and manufacturing main devices like server, workstation, desktop and laptop, peripherals like monitor, printer and scanner, and network devices like switch, hub, LAN card, and modem.

(4) Primary technologies of internet include super-high-speed network, B2B/B2C solutions, content and security system.

(5) Primary technologies of software industry cover system program, utility program and application program. Especially, application programs with high value-added include entertainment and edutainment software targeting consumers, and business solutions like ERP, SCM and DB.

The role of ICT in manufacturing has increased steadily throughout the last half of the 20th century. The trend towards greater computerization of manufacturing seems certain to continue well into the 21st century, although the pace of automation has sometimes slowed to address problems resulting from increased automation, such as those relating to the "human factor" or difficulties in cost justifying new technologies. ICT figures prominently in popular visions of the "factory of the future". Improvements in expert systems, vision systems, and neural networks will most certainly result in improvements in the systems that support decision making as well as the systems that direct and control manufacturing processes.

[19] Gunasekaran and McGaughey(2002) illustrated many cases of information technology/information systems(IT/IS).

4. General Trend of ICT in Asian Countries

A. The IT Service

Due to the development of IT technology, its service market structure has recently experienced substantial changes which include contents digitalization, broadband network, and interactive information and communication service. As a result, fusion between communication and broadcasting (multimedia), and integration of wire and wireless communications are caused, creating information and communication businesses under the new paradigm (Lim, 1997b).

World mobile communication market shows a rapid growth in its scale due to the appearance of various carriers and increased demand for mobile communication service. Ten years ago, the world mobile subscribers were only 10 million, but it increased by 100 times to 1 billion by the end of 2002, recording high annual average growth rate 50%. Mobile communication market is expected to show more accelerated growth as IMT-2000 service launches. At this speed, mobile subscribers will surpass fixed-line subscribers five to 10 years later.

The ICT service market in the Asia-Pacific region is very promising. Asia is the market that makes the largest contribution to the growth of world mobile communication market. In May 2001, Asian mobile subscribers were 233,730,000, accounting for 31.9% of world mobile subscribers. The reason why Asian mobile communication market has risen as the most important market is because Asian population reaches 3,380 million or more than half of world population and mobile telephone diffusion ratio in Asia is only 11%, compared with 70% range in Europe and 40% range in USA. The market is expected to expand from US $ 680 billion in 1998 (30% of world market) to US $ 1200 billion in 2004 (40% of world market) (Lim, 2003c).

Asian region is the world-largest area demanding mobile communication service. China has large potential and explosive market growth ratio through accession to the WTO (Nov. 10, 2001) and Japan shows continued stable demand. For this growth ratio of Asian market and large potential in emerging-markets like China, the world mobile telecom carriers accelerate their entry into Asian market. Internet users in Northeast Asia are expected to outrun North America before long with advent of information age.

Therefore, Japan, Korea and China have unlimited chance of collaborating in the ICT service. Japan has devised an idea of “e-Japan” and pushed forward with an independent and active plan to promote information drive in order to revive its

economy. Also, Korea and China agreed on building mutual cooperation in the ICT industry in the Korea-China summit talks (September~October 2000).

B. The Digitalization Level and Potential Growth of the Asian ICT

Based on the statistical data of IMD (2000), the author will evaluate the digital growth base in Asian countries and examine the possibility of Asian countries' cooperation in ICT industry. As shown by Table 14, Asian countries' overall digitalization level is much more backward than USA's.

Table 14. Comparative view of digitalization level in selected countries

Country / ICT	Japan	Korea	China	Taiwan	Singapore	Malaysia	USA
Computer per 1,000 persons	60.4	33.6	1.8	48.3	72.5	17.5	100.0
Host per 1,000 persons	12.2	4.4	0.04	14.7	16.2	2.0	100.0
Internet users in population	43.9	43.8	2.0	44.5	86.1	14.0	100.0
E-commerce progress level	58.8	75.8	68.6	78.1	95.6	58.1	100.0

Source : IMD, *The World Competitiveness Yearbook*, 2000 (www.nua.ie).
Note : Each figure is a relative value based on the assumption that USA's value is 100.

The digitalization level of Japan is unexpectedly low, in spite of its competitiveness base. Korea's digitalization level is higher than China's, but lower than Taiwan's and Singapore's. China shows a lower digitalization level in the aspect of computer per 1,000 persons, host per 1,000 persons, internet users in population, and e-commerce progress level. Based on USA = 100.0, China's e-commerce progress level (68.6) is lower than Singapore's (95.6), Taiwan's (78.1), and Korea's (75.8), but higher than Japan's (58.8) and Malaysia (58.1). It is remarkable that Korea's e-commerce progress level (75.8) is much higher than Japan's (58.8). Korea's internet users in population (43.8) is almost equal to Japan's (43.9) or Taiwan's (44.5), more than 20 times higher than China's (2.0) but almost half of Singapore's (86.1). In terms of digital use level, Korea outperforms other Asian countries. However, the number of computers and that of internet hosts in Korea are, respectively, 33.6% and 4.4% of USA's, being much lower than 72.5% and 16.2% of Singapore and 43.8% and 14.7% of Taiwan's.

Since knowledge and technology are important sources of competitiveness in digital growth strategy, it is very important to invest in R&D and reserve competent R&D staffs. As shown by Table 15, based on USA=100.0, Japan's R&D expenditure per head

(115.1), R&D staff per 1,000 persons (190.2), and retention of brains at home (80.9) outperform other countries, so Japan is most likely to become a digital power in the world. Singapore ranks the 2nd in Asia. Korea's potential for long-term digital growth is higher than China's but much lower than Japan's. Korea's R&D expenditure and staff (20.7 and 79.6) are lower than Singapore's (45.7 and 103.5) and Taiwan's (28.8 and 125.0). Therefore, Korea's digital growth base is relatively weaker and may suffer from higher brain drain of researchers to foreign countries than Japan or Singapore does in the long run.

Table 15. Comparative view of potential for long-term digital growth of selected countries

Items	Japan	Korea	China	Taiwan	Singapore	Malaysia	USA
R&D expenditure per head	115.1	20.7	0.6	28.8	45.7	1.1	100.0
R&D staff per 1,000 persons	190.2	79.6	16.1	125.0	103.5	8.3	100.0
Retention of brains at home	80.9	63.7	46.9	61.0	67.3	61.7	100.0

Source : IMD, The World Competitiveness Yearbook, 2000; www.nua.ie
Note : Same as in Table 14.

C. Enterprise Informatization Software and ERP System

Enterprise information software is designed to provide the planning and simulation functions, which give an optimal solution to the business problems such as minimization of raw material cost, optimization of production schedule, location of factory and logistics center, optimization of transportation, and portfolio for optimal management of investment assets. Enterprise informatization software can be divided into system software, support software and application software, each holding the following elementary technologies, as shown by Table 16.

Table 16. The related technologies of enterprise informatization software

System Software	Support Software	Application Software
• OS • DB • Network operation	• Management of electronic documents • Internet • Groupware	• Financial management • Production management • HRM (Human Resource Management) • PDM (Product Data Management) • SCM (Supply Chain Management) • System development methodology

Source : Lim (2003c).

Asian companies can increase mutual synergic effects by sharing and combining their business models in connection with ERP (Enterprise Resource Planning) which reflects law and busieness practices, management behaviors, and cultural and legal characteristics of the adopted company. Building an Asian common B2B e-marketplace for each industry category will increase further the effects expected from digitalization.

ERP as one of enterprise information software has become a very important core element in today's information society.[20] ERP integrates all business processes including purchasing, production, sales, inventory, accounting, and personnel affairs, and provide transparent flow of information and materials to enable elaborate business management. Such an enterprise integration solution as ERP is nowadays considered as a useful tool for process innovation for enhancing business competitiveness. ERP holds sway over the viability and development of all enterprises belonging to the relevant country, and determines their competitiveness.

Along with a strong drive towards reform and liberalization since the end of 1970s, China's private companies have rapidly grown, and enterprise informatization has become more and more requested. Chinese private companies attempt informatization by introducing ERP systems from Germany or USA. However, these companies suffer from some internal difficulties in adopting ERP system due to the China's unique laws, cultural characteristics, and business practices. Chinese government has accelerated R&D for developing its own ERP system on the basis of Linux and Unix in terms of national strategy for the purpose of avoiding dependence on the Microsoft. However, it will take much time and effort for China to develop a well-structured ERP system due to China's less-developed technologies and experiences in enterprise integration. This has led a part of Chinese ERP vendors to have a strong interest in strategic alliance with ERP companies in Japan, Korea, and other countries and importation of the relevant technology from them.

Inevitably, ERP solution itself reflects the business practices, management behaviors, and cultural and legal characteristics of companies in each country. If Asian companies rely on the Western solutions in introducing enterprise integration solutions, they are most likely to gain much lower system utility than the companies belonged to the culture bloc where the relevant solutions are developed, because of cultural heterogeneity, language barrier, and particularity in law and business practice. Since Japan, Korea and China possess the same culture and show similar business practices, they have high possibility of strategic alliance in the ICT industry.

[20] World ERP market has recorded an explosive growth for the last ten years. Five ERP giants called JBPOS (J.D.Edwards, Baan, Oracle, PeopleSoft and SAP) have been dominant players.

5. China- Korea-Japan Strategic Alliance in IT Industry

The three Northeast Asian countries have discussed FTA and various forms of regional cooperation. It is necessary to have a joint strategy for building a digital network in link with the three countries' growing and expanding of their strategic alliances in the IT industry. It should be noted that efficient logistics flow is indispensable for a success in digitalization growth strategy. Due to the attributes of network economy, as more countries are linked, synergic effects will get higher. Concretely, Asian companies can increase mutual synergic effects by sharing and combining their business models. Building an Asian common B2B e-marketplace for each industry category will increase further the effects expected from digitalization.

There are few recent statistical data, either cross sectional or time series, on Korea-China-Japan strategic alliance in the IT industry. This study has only to rely on the statistical data published in daily newspapers and business magazines for the last three years (2000~2002). Table 17 shows the characteristics of strategic alliances in the IT industry among Korea, China and Japan.

Table 17. Trend in the strategic alliance in the IT industry by Korea, China and Japan and its outlook

(Unit : case, %)

Classification		2000	2001	2002	Remarks	Outlook
Number of total strategic alliance in the whole industry (unit : case)	Korea	815	806	561	Steadiness /decrease	Mid-and-long term increase after recovery in IT economy
	China	107	131	148	Increase	Rapid increase
	Japan	129	151	200	Increase	Rapid increase
IT's Strategic alliance as percentage of total strategic alliance (unit : %)	Korea	62.6	66.7	47.1	Increase/ decrease	Mid-and-long term increase after recovery in IT economy
	China	65.4	52.7	49.3	Decrease	Mid-and-long term increase after recovery in IT economy
	Japan	41.1	33.1	26.0	Decrease	Mid-and-long term increase after recovery in IT economy
Ratio of technology-related strategic alliance to total strategic alliance in the whole industry (unit : %)	Korea	30.5 (16.3)[1)]	28.8 (13.8)[1)]	26.2 (14.7)[1)]	Decrease (Decrease/ steadiness)	Increase through mid-and-long term strategic promotion
	China	29.4 (8.1)[1)]	32.9 (8.7)[1)]	36.5 (10.2)[1)]	Increase/ decrease (Increase/ decrease)	Increase through mid-and-long term strategic promotion
	Japan	45.8 (21.1)[1)]	51.1 (21.7)[1)]	36.6 (22.8)[1)]	Increase/ decrease (Increase/ decrease)	Increase through mid-and-long term strategic promotion

Ratio of tecnology-related strategic alliance in the IT industry to total strategic alliance in the whole industry (unit : %)	Korea	34.5	32.1	34.0	Decrease / Increase	Steady, reflecting the IT slump
	China	26.9	34.7	33.0	Increase / decrease	Downward, reflecting the IT slump
	Japan	47.8	61.9	45.3	Increase/ decrease	Same as above

Note : 1) The figures in the parentheses represent the portion of strategic alliance for joint R&D.

First, Asia has increased its portion in the strategic alliance in the world ICT industry. Korea shows the highest number of the strategic alliance case in Northeast Asian countries, followed by Japan and China, in order. However, the portion of strategic alliance in the IT industry of the three countries has decreased between 2001 and 2002, reflecting the slump of the IT industry. During the same time, Korea's portion decreased from 66.7% to 47.1%, China's decreased from 52.7% to 49.3%, and Japan's decreased from 33.1% to 26.0%. Korea was most influenced by the slump of the IT industry. Moreover, Korea's number of total strategic alliance in the whole industry also decreased between 2001 and 2002, whereas Japan's and China's showed steady growth.

Second, based on 2001, the portion of technology-related strategic alliance in the IT industry was 51.1% in Japan, 32.9% in China, and 28.8% in Korea, whereas the portion of joint R&D was 21.7% in Japan, 13.8% in Korea, and 8.7% in China in the same industry. Japan's portion of technology-related strategic alliance in the IT industry and that of joint R&D in the same industry were highest in 2001. The previously-described observation indicates the generally-recognized technology difference among the three countries. China and Korea rely more on technology licensing than on R&D and China's preference for the former than Korea's in the IT industry.

Third, examining the change in the pattern of their technology alliance between 2001 and 2002, China's technology licensing alliance increasesd but both Korea's and Japan's decreased, whereas joint R&D of the three countries increased. This may imply that their strategic alliance in the IT industry has been shifting from technology license alliance to joint R&D. This shift can be considered to be desirable, since this trend indicates that the three countries are not indulged in using already-developed technologies but prefer to invest R&D on a new IT technology.

As shown by Table 18, the portion of strategic alliance among Korea, China and Japan was higher than that of strategic alliance with other countries than USA for the years : 2000~2002.[21] It seems that strategic alliances among the three Asian countries were considered important by themselves. China preferred strategic alliance with Korean large companies, while Korea did strategic alliance with Japanese large companies. On the contrary, Japanese large companies had competitive advantage over

[21] Korea, China and Japan are the second-place strategic alliance partners of USA.

or preference for Korean venture businesses, while Korean large companies had competitive advantage over or preference for a variety of companies in China.

Most of strategic alliances between Korea and China were made between Korean large companies and Chinese counterparts for the purpose of introducting knowledge, technology, and capital. Their primary target business categories were communication equipment and its parts, internet business, content, solution, and software development. The highest portion was taken by their strategic alliances of large companies specialized in producing communication equipment and providing IT service. The major portion of their strategic alliances above was technology-related strategic alliances (joint R&D and technology licensing), which have continued to grow. Generally, China has preferred joint venture and technology alliance with Korea.

Table 18. Trend in the Korea-China-Japan strategic alliance and its outlook

(Unit : case, %)

Classification		2000	2001	2002	Remarks	Outlook
The number of strategic alliance cases between both countries[1)]	Korea-China	50 (6.1)	98 (12.2)	75 (13.4)	Rapid portion increase	Rapid increase
	Korea-Japan	89 (10.9)	76 (9.4)	81 (14.4)	Rapid portion increase	Rapid increase
	China-Japan	1 (4.9)	8 (5.3)	19 (9.5)	Increase Sufficient statistics not available	Rapid increase
The number of IT industry related strategic alliance between both countries [1)]	Korea-China	40 (4.9)	95 (11.7)	42 (7.5)	Increase/ decrease	Expected to show mid-and-long term increase in consideration of present IT slump
	Korea-Japan	64 (7.9)	51 (6.3)	46 (8.2)	Increase	Expected to show mid-and-long term increase in consideration of present IT slump
	China-Japan	3 (2.8)	3 (2.3)	2 (1.4)	Decrease Sufficient statistics not available	Expected to show mid-and-long term increase in consideration of present IT slump

Note: 1) The figures in the parentheses are ratio to total number of strategic alliance cases.

On the other hand, the strategic alliances between Korea and Japan were dominated by the alliance of Koren venture businesses (dotcoms showing comparative advantage in solution or software) and Japanese large companies in the IT industry. Their technology-related strategic alliance in the same industry had the highest portion in the alliance of Korean IT companies and Japanese counterparts. Korea's strategic alliance

with Japan in the same industry had a very low portion of joint venture, unlike its strategic alliance with China. If Korea and Japan sign an FTA in the near future,[22] their strategic alliances will evolve more vigorously than Korea-China strategic alliances in the same industry.

In connection with the preceding expectation, since 2000, the trade between Korea and Japan shows a significant change in the IT industry. During the time period of 2000~2002, Japan's import of semidonductor from Korea has been increased by 56.1% while its total import of from Korea has increased only 6.2, in spite of the recent IT recession and semiconductor's price fall in 2001. In 2001, DRAM occupied the dominant share of Japan's import of semiconductor from Korea. In 2002, Japan's import of DRAM from Korea decreased (although it increased in terms of quantity) while its import of other products like ROM or analog IC from Korea increased. Until then, Korea had not been able to penetrate the Japanese market, especially, in the field of capital goods or intermediary goods like machinery parts. However, Korea stretches out its tentacle over Japanese semiconductor market.[23]

Ⅳ. Concluding Remarks

This paper has analyzed trade and investment relationships of China-Korea-Japan and suggested some strategic considerations for their strategic alliance, particularly on IT industry in an attempt to reconcile their chronic trade imbalance (tail-to-tail structure of trade balance : Korea continues to record deficit in trade with Japan, Japan continues to record deficit in trade with China, and China continues to record deficit in trade with Korea) and trade conflicts (e.g., anti-dumping issues), thereby providing a foundation for their FTA in the future. For this purpose, this study has analyzed global trend of ICT in ASIAN countries, and characteristics of Chna-Korea-Japan's strategic alliance in ICT based on the statistical data published in daily newspaper and business magazines for the last three years(2000~2002).

For the last ten years or more, trade among Japan, Korea and China has recorded an explosive growth due to many factors including China's high economic growth at annual average 10% and steady economic liberalization, and the three countries' geographic closeness and complementary industrial structure. In terms of current price, the volume of trade among the three countries jumped up from US $ 41,820 million to US $ 189,120 million in 2002, at much faster speed than the average growth rate of world trade. If Japanese economy escapes from the dark tunnel of recession lasted for

[22] For details, see Lim (2003d).
[23] Lee and Lim(2001) examined the different technological evolution of the selected industries in Korea, including the D-RAM, automobile, mobile phone, consumer electronics, personal computer and machine tool industries, and emphasized the importance of technological collaboration with advanced countries.

last decade, Japan's import from Korea and China would increase more, and division of labor between Korea and Japan will be more deepened.

However, the three countries' trade volume recorded 18% in 2000, compared to NAFTA (56%) and 15 EU countries (62%) (Lim, 2001a). Moreover, according to a survey by the Korea Institute for Industrial Economics & Trade (KIET), low-level technology industry as percentage of total intra-industry trade among the three countries has been highest, and the portions of middle-and-high-level technology industry (10~15 %) and high-tech industry (10%) get lower.

This study has analyzed the structure of trade and investment among Japan, Korea, and China during the time period : 1990 ~ 2002, by using HS 4 classification to calculate the three countries' intra-industry trade indices, both vertical and horizontal. From this analysis, we can derive the following conclusion : China's high economic growth and accelerated liberalization played an important role for vitalizing the regional trade among the three countries and forming a very complementary trade pattern based on each country's own comparative advantage over other trading partners. The growth of portion of the manufactured goods in China's trade with Korea and Japan has accelerated shifting trade pattern of the three countries from inter-industry trade (which is mainly determined by difference in factor endowment) to intra-industry trade (which is closely related to price and quality competitiveness). Their intra-industry trade has persistently been growing, and its major determinants are estimated to be per capita GDP and the ratio of manufactured export goods to total export of each country, and intra-industry trade index of Japan-Korea has been larger than that of Korea-China and that of Japan-China. Intra-industry trade among Korea, China, and Japan increased vertical intra-process division of labor together with horizontal product-differentiated division of labor. Due to the technological gap between Japan and the other two countries, Japan specialized in upper production process and high-end and non-universal products, whereas Korea and China specialized in lower production process and low-end and universal products.

As the trade structure of the three countries has shifted from simple trade to intra-industry trade in connection with division of labor emboding capital and technology, intermediary goods have taken central place of final goods in their trade goods, which in turn providing structural expansion of their intra-industry trade. The recent intra-industry division of labor among the three countries is characterized by the fact that intra-firm trade between Japanese firms and their partners in hosting countries, and between the parent firms and their partners in Japan have taken increasingly larger share through Japan's direct investments to China and Korea and its strategic alliance with the other two partners.

Strategic alliance in Northeast Asia is expected to grow much faster than in other regions in the period up to 2010, based on the observation that Chinese accession to the

WTO (Nov. 10, 2001), Chinese economy's take-off along with the 2008 Beijing Olympics, Japan's escape from long-term economic slump, and visible economic cooperation in Northeast Asia will exert combined influences. There has been a small number of multilateral strategic alliances involving all of the three Northeast Asian countries.

Examining export-based complementary relationship of the three countries for the two years : 1997 and 2001, China-Japan's export coupling is estimated to have been higher than Korea-Japan's. That is, China stands higher above Korea in terms of export coupling with Japanese market. Korea's export coupling with China is higher than Japan's export coupling with China. This suggests that Korea standed above Japan in terms of export-based complementary relationship with Chinese market. Meanwhile, Japan's investment coupling with Korea was much higher than Japan's investment coupling with China. This implies that investment-based complementary relationship between Japan and Korea was higher than the relationship between Japan and China. The preceding analysis indicates that Korea can execute a bridging role for economic cooperation of the three countries in the aspect of higher export-based complementarity relationship between Korea and China and higher investment-based complementarity relationship between Korea and Japan.

Korea can also play a pivotal role in the creation of Northeast Asian economic bloc covering production and trade by expanding and providing basic infrastructure like logistics. Due to the increased trade of Northeast Asian countries and the changes in world distribution environment, a logistic system for off-shore countries around Northeast Asia must be created. Also, a distribution network for streaming logistics flow well among Northeast Asian countries must be built. Establishment of a logistic system among on-shore and off-shore countries in Northeast Asia will be essential for providing good supply of export commodities of Northeast Asian countries, improving competitiveness of export industry due to a lower logistics cost, expanding international division of labor among Northeast Asian countries, internationalizing Northeast Asian region, and developing major regional cities into global business bases. Korea is now implementing a strategy of promoting a two-phase project for developing the Inchon International Airport into a Northeast Asian hub, expanding Busan Harbor and Gwanyang Harbor, networking the silk roads connecting Korea and Eurasia, and developing into a logistics center of Northeast Asia through expansion of international logistics base facilities. To this end, Korea must attract Asian headquarters of world-famous companies by creating a foreigner-friendly management and living environment, and provide enhanced supports for primary industrial base areas, including additional designation of free trade zone and foreign firm-dedicated industrial complex. Also, Korea must blossom international financial transactions by founding an international financial center.

The author would like to assert that the world order of today comprises political order, economic order (unification of economic institutions or policies), and information order, which provides a base for political and social order and leads to socioeconomic integration. The information order is most needed today due to huge cultural diversity in the Asia-Pacific region, which should be established by developing the plans for removing digital gap in the region. There is a large digital gap in Asian region, i.e. between developed digital players like Korea, Japan, Singapore, Hong Kong, Taiwan, and other Asian developing countries. If a Northeast Asian IT Community (NAITC) sharing knowledge and technology is formed and strategic ties of private companies in the IT industry are more tightened, it would be a win-win strategy giving benefits to all the three countries. The NAITC means a regional economic cooperation body operating a common program for developing technologies and services of IT and eliminating digital gap among Northeast Asian countries. Further, the NAITC is a cooperation body precedent to the NATC (Northeast Asian Technology Community).

The establishment of the information order in the region can be also motivated and accelerated by vitalizing the Korea-China-Japan strategic alliance in the IT industry. For this, the three countries should promote joint R&D and technology standardization in relation to mobile communication technology (system) through their strategic alliances in the IT industry. Standardization in mobile communication technology will allow them to build digital network easily, and it will further enable the three countries to enhance their negotiation power to cope actively with digitalization in world economy. Since W-CDMA (led by Europe and Japan), CDMA (led by Korea and USA) and TD-SCDMA (developed by China) compete in Chinese and world market, the IT technology standardization is indispensable for joint interest of world as well as the three countries.

The government of each country should build the infrastructure and the business environment for vitalizing their strategic alliances and international joint research, and industrial/technological cooperation, and for establishing the IT technology standards.[24] Joint body between private sector and government also should provide services like information provision, consulting, training, contract support, and aid for dispute resolution. It should be also noted that despite the increased demand for technological cooperation among the three countries, a S&T cooperation body among the three countries has never been formed. Therefore, we may refer to the European S&T collaboration body, EUREKA and COST[25] in an attempt to develop the aforementioned NAITC and NATC to launch in Northeast Asian region,

[24] Of course, government's direct intervention should be minimized, and the governments should provide indirect support in consideration of the WTO rules. For details, see Lim (1998b).

[25] COST (European Co-operation in the field of scientific and technical research) is the longest running framework for research co-operation in Europe, having been established in 1971 by a Ministerial Conference attended by Ministers for Science and Technology from 19 countries.

Finally, the author would like to leave a long-cherished remark on the future of Asia in conjuction with the importance of China-Korea-Japan's strategic alliance in IT industry[26] : it is worthwhile to note that, because industrialization in Asia was later than in the West, Asia might have been relatively backward and most of Asian countries might have become colonies of the West. Again, even though information drive in Asia started later than the West, if Asia does not pay a keen attention to catch-up, it would be again under 'relative backwardness' and it may become a 'colony of information instead of territory'.

< References >

Archibugi, Daniele and Pietrobelli, Carlo (2003), "The Globalization of technology and its implications for developing countries : windows of opportunity or further burden?", *Technological Forecasting and Social Change*, Vol. 70, pp. 861~883.

Aturupane, C., Djankov, and B. Hoekman (1999), "Determinants of Intra-Industry Trade between East and West Europe", *Weltwirtschaftliches Archiv* 135(1), pp. 62~81.

Aquino, A. (1981), "Changes over time in the pattern of comparative advantage in manufactures : an empirical analysis of the period 1962~1974", *European Economic Review*, Vol. 15, pp. 41~62.

Balassa, B. (1979), "The changing pattern of comparative advantage in manufactured goods", *Review of Economics and Statistics*, Vol. 61, pp. 259~266.

Balassa, B. (ed.) (1982), *Development Strategies in Semi-Industrialized Economics*, Baltimore : Johns Hopkins University Press.

Danniels, Peter L. (1997), "National technological gaps and trade-an empirical study of the influence of globalization", *Research Policy*, Vol. 25, pp. 1189~1207.

Danniels, P. and Moulaert, P. (1991), *The Changing Geography of Advanced Producer Services : Theoretical and Empirical Perspectives*, Belhaven Press, London.

Dosi, G., K. Pavitt and L. Soete (1990), *The Economics of Technical Change and International Trade* (Harvester Wheatsheaf, New York).

Dunning, J. H. (1995), "Reappraising the eclectic paradigm in an age of alliance capitalism", *Journal of International Business Studies*, Vol. 26, No. 3, pp. 461~491.

Dunning, J. H. (1997), *Alliance Capitalism and Global Business*, Routledge, London.

Duysters, G., Hagedoorn, J. (1995), "Strategic groups and inter-firm networks international high-tech industries", *Journal of Management Studies*, Vol. 32, No. 3, pp. 359~381.

Duysters, Geert and Hagedoorn, John (1996), "Internationalization of corporate technology through strategic partnering : an empirical innovation", *Research Policy*", Vol. 15, pp. 1~12.

[26] Lim(1999).

Georghiou, Luke (1998), “Global cooperation in research, *Research Policy*, Vol. 27, pp. 611~626.

Georghiou, Luke (2001), “Evolving frameworks for European collaboration in research and technology”, *Research Policy*, Vol. 30, pp. 891~903.

Gerlach, M. L. (1992), *Alliance Capitalism: The Social Organization of Japanese Business*, Univ. Press, Oxford.

Grubel, H. G. and P. J. Lloyd (1975), *Intra-Industry Trade : The Theory and Measurement of International Trade in Differential Products*, London : Macmillan.

Grupp, H., 1991, “Innovation dynamics in OECD countries”, in : OECD, *Technology and Productivity : The Challenge for Economic Policy* (OECD, Paris).

Gunasekaran, A. and Nath, B. (1997), “The role of information technology in business process reengineering”, *International Journal of Production Economics*, Vol. 50, pp. 91~104.

Gunasekaran, A. and McGaughey Ronald (2002)**,** “Information technology/information systems in 21st century manufacturing”, *International Journal of Production Economics*, Vol. 75.

Gutterman, Alan S. (1995), *The Law of Domestic and International Strategic Aliiances : A Survey for Corporate Management*, Westport, CT : Quorum Books.

Hagedoorn, J. (1993a), “Understanding the rationale of strategic technology partnering : internationalization modes of cooperation and sectoral differences”, *Strategic Management Journal*, Vol. 14, pp. 371~385.

Hagedoorn, J. (1993b), “Strategic technology alliances and modes of cooperation in high-technology industries”, In: Grabher, G. (Ed), *The Embedded Firm*, Routledge, London.

Hagedoorn, J. (1995), “Strategic technology partnering during the 1980s : trends, networks and corporate patterns in non-core technologies”, *Research Policy*, Vol. 24, pp. 207~231.

Hagedoorn, J., Schakenraad, J. (1992), “Leading companies and networks of strategic alliances in information technologies”, *Research Policy*, Vol. 21, pp. 163~190.

IMD (2000), *The World Competitiveness Yearbook*, (www.nua.ie).

Japan External Trade Organization (www.jetro.or.jp).

Jeffrey James (2002), Technology, Globalization and Poverty, Edward Elgar, Cheltenham, UK.

KOTIS (Korea Trade Information Services) *Trade Statistics* (www.kotis.net).

Lal, K (1999), “Determinants of the adoption of Information Technology : a case study of electrical and electronic goods manufacturing firms in Inda”, *Research Policy*, No. 28, pp. 667~680.

Le, C. D. (1987), “The role of R&D in high-technology trade : an empirical analysis”, *Atlantic Economic Journal*, Vol. 15, pp. 32~38.

Lee, Keun and Lim, Chaisung (2001), Technological regimes, catching-up and leapfrogging : findings from the Korean industries, *Research Policy*, Vol. 30, pp. 459~483.

Lee, Shin-Young (2002), "The Revival of Merchant Prince Changpogo and His Commercial Empire in the 21st Century," presented at 2002 Korea-China-Japan FTA Nanjing International Trade Policy Forum and International Academic Conference, Seoul. *(in Korean)*

Lim, Yang Taek (1994), "Econometric Study on the Technology Gap between Korea and Japan : the General Machinery and Electric & Electronic Industries," *Proceedings of Economic Development and Technological Progress of Japan and Korea : Their Role in East Asia*, the Workshop and Seminar, Kobe, Japan, February 17~18.

Lim, Yang-Taek (1995), *People shall perish where there is no vision*, Seoul: Maeil Econpmic Daily Press. *(in Korean)*

Lim, Yang-Taek (1996a), "Design of Northeast Asian Economic Bloc in the 21st Century and Korea's Strategies," *Paper Collection of Korea Northern Society*, Issue 2, Seoul: Korea Northern Society. *(in Korean)*

Lim, Yang Taek (1996b), "TRADP and Cooperation among South and North Korea and Russia", presented at the International Conference on Socioeconomic Changes and Investment Climate in the Far East of Russia held by The Institute for Sino-Soviet, Hanyang University, Seoul, April 16~17.

Lim, Yang-Taek (1997a), "Trends in International Economic Cooperation in Northeast Asia and Methods for Korea's Entry into Foreign Markets: Focusing on Cooperation in industry, technology and resource", *Paper Collection of Korea Northern Society*, Issue 3, Seoul: Korea Northern Society. *(in Korean)*

Lim, Yang-Taek (1997b), "General Trend of World Information and Telecommunication Market and Korea's IT Policy", *Economic Studies*, Hanyang Economic Research Institute, Vol. 18, No. 2, November. *(in Korean)*

Lim, Yang-Taek (1998a), *Northeast Asian Economic Cooperation and Korea's Strategy for Northern March*, Seoul: Damul Press. *(in Korean)*

Lim, Yang Taek (1998b), *A Study on Governmental Support for R&D*, Seoul : Korea Development Institute, 1998. *(in Korean)*

Lim, Yang-Taek (1999), *A Forecast on the Future of Asia*, Seoul: Maeil Economic Daily News Publisher (in Korean) and Beijing : Chinese Social Science Institute. *(in Chinese)*

Lim, Yang-Taek (2000), "Development Strategy for Korea-Chinese Economic Cooperation in the 21st Century", presented at International Symposium: Chinese Association of Social Science, Beijing, November 4, 2000. *(in Korean)*

Lim, Yang-Taek (2001a), "Development Strategy for Korea-China-Japan Economic Cooperation under the International Economic Order in the 21st Century," *Korean*

Reunification in the Era of Cooperation between South Korea and North Korea, Division of National Reunification Movement, Seoul : Young Korean Academy Press. *(in Korean)*

Lim, Yang Taek (2001b), "A New Proposal for a Northeast Asian Peace City for Securing Peace and Cooperation on the Korean Peninsula", *The Bi - Monthly Journal of the BWW Society* / Institute for the Advancement of Positive Global Solutions, Vo. 1, No. 2.

Lim, Yang-Taek (2002), "Evaluation of Korea-China Industrial and Technological Cooperation and Some Directions for Its Further Development", presented at the 24th ACAES Conference, jointly sponsored by the American Committee on Asian Economic Studies (ACAES), Peking University and China Reform Forum (CRF) in Beijing on May 27~29, 2002, under the theme of the Conference : Asian Economic Cooperation in the New Millenium : China's Economic Presence.

Lim, Yang Taek (2003a), "Korea-China Industrial and Technological Cooperation and Further Development Strategy", *Journal of Asian Economics*, Vol. 14, No. 2, March~April.

Lim, Yang-Taek (2003b), *A Study on the Import Restrictions of China since Chinese Accession to the WTO*, Research Paper, Seoul : Korea International Trade Association. *(in Korean)*

Lim, Yang-Taek (2003c), *A Study on Technology Roadmap for the Industrial Competitiveness Improvement of Korean Promising Industries*, Hanyang University Reliability Analysis Research Center, September.

Lim, Yang-Taek (2003d), “A Development Strategy for Industrial/Technological Cooperation between Korea, China and Japan and their FTA”, *Economic Studies*, Vol. 24, No. 2, November.

Lim, Yang-Taek (2004a), “A New Measurement of the Level of S&T and Some Econometric Applications”, paper presented at the PICMET(Portland International Conference Management of Engineering and Technology) ’04 Conference (July 31~August 04) in Seoul.

Lim, Yang-Taek (2004b), "Korea-China Technological Cooperation”, *Asian Economic Cooperation in the New Millennium*, World Scientific Publishing Co. (http://www.wspc.com.sg/books/economics/aeiede.shtml)

Marxt, Christian and Link, Patrick (2002), “Success factors for cooperative ventures in innovation and production systems”, *Interntional Journal of Production Economics*, Vol. 77, pp. 219~229.

Pavitt, K. and L. Soete (1980), “Innovative activities and export shares : some comparisons between industries and countries”, in : K. Pavitt (Editor), *Technical Innovation and British Economic Performance* (Science Policy Research Unit, Macmillan, London).

Santangelo, Grazia D. (2000), “Corporate strategic technological partnerships in the European information and communications technology industry”, *Research Policy*, Vol. 29, pp. 1015~1031.

Soete, L., 1981, “A general test of technology gap trade theory”, *Weltwirtschaftliches Archiv*, 117, 638-660.

Walker, W. B., 1979, *Industrial Innovation and International Trading Performance* (JAI Press Inc., Greenwich).

Zumbrunnen, Craig (1990), "Resources," Allen Rogers(eds.), *The Soviet Far East: Geographical Perspectives on Development*, London and New York: Routledge.