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Towards a Dynamic Wave: IT Cooperation of China -Korea- Japan

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INTRODUCTION

The rich potential for regional cooperation between 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 a huge labor force, but less-developed technologies. Korea has medium-level technology and a wealth of experience in economic development, but few natural resources. Although Japan has high technology and abundant capital, it needs a stable supply of natural resources. Moreover, its skilled labor force is moving towards old age, and the labor shortage is an urgent task that Japan must solve now and in the future. If the aforementioned countries' attributes are efficiently combined to promote regional economic cooperation, Japan, Korea, and China could greatly benefit, and could then lead the other Asian countries.

Economic cooperation between Japan, Korea and China is significant in terms of the current socioeconomic situation of each country. Japan has been trying to escape from the prolonged recession of the *Heisei* era. Korea has been restructuring the basic framework of intensive economic development, since the foreign exchange crisis of 1997-1998. China has shifted from a socialist economy to a market economic system and is now a member of the WTO (November 10, 2001).

The starting point of Northeast Asian economic cooperation lies in the promotion of mutual complementary economic cooperation of Japan, Korea and China, known as NADEs (Northeast Asia's Dynamic Economics). In connection with the idea of a Northeast Asian economic bloc, the author would like to emphasize that the three countries need to expand industrial / technological cooperation, especially in the IT industry, for the following reasons:

First, the three countries' industrial / technological cooperation can yield more and better performances in their trade and investment, avoiding mutually harmful trade conflicts resulting from the fiercer competition. Specifically, the so-called "flying geese" model of Japan, Korea and China has collapsed. From the standpoint of this model, Japan, Korea and China, in that order, had experienced successful commercialization of new technologies, construction of a mass-production system, and transfer of production base to foreign countries. In the 1990s, Japan made a slow transition to new industry and delayed the transfer of traditional industries to Korea and China. This led to the overlapping of industry among the three countries. Moreover, Korea and China have attracted both an IT and automobile industry thanks to each government's energetic policy support and attraction of foreign capital. As a result, competition between the two countries and Japan has become fierce. For this reason, industrial development among the three countries is moving farther away 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. Ever since the Chinese market opening was expanded through its accession to the WTO, Western firms, including U.S. players, have accelerated the transfer of their industries and products through direct investments to China, regardless of its technological development stage. Consequently, China is quickly catching up with Korea and Japan, and the three countries are being driven toward even fiercer competition.

Second, the three countries' industrial / technological cooperation in the IT industry can accelerate the drive towards a regional economic bloc. Spurred by the experiences of NAFTA and the EU, since 2001, Asian countries have entered into a heated race to sign FTAs. For the past three years since 2001, 16 FTAs in Asia were signed, and 40 FTAs in the same region are currently being pushed forward. Japan will complete comprehensive negotiations for an economic alliance with ASEAN, which includes FTAs by 2012. China plans to sign an FTA with six countries, including Singapore, by 2010, and with four countries including Vietnam, by 2015.

The discussion of a Korea-China-Japan FTA is actually the starting point for economic integration in Asia.[1)] Recently, the Summit Meeting of ASEAN+3 (Korea, China, and Japan) was held in Bali, Indonesia on October 7, 2003, where the first common declaration in history was announced. The declaration has the following framework: (1) The three countries agreed to intensify economic cooperation covering trade and investment, push forward joint efforts in environment, energy and resource development, and jointly study an FTA; and (2) Based on their cooperation in providing a peaceful solution on the North Korean nuclear issue, the three countries agreed to increase joint efforts to develop multilateral cooperation in East Asia, and take political, diplomatic, and administrative actions including export controls on weapons of mass

1) Lim Yang-Taek, "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* (in Korean), (Seoul: Young Korean Academy Press, 2001); Yang-Taek Lim, "A Development Strategy for Industrial / Technological Cooperation between Korea, China and Japan and their FTA," *Economic Studies*, Vol. 24, No. 2, (November 2003a).

destruction (WMD) by strengthening cooperation related to mutual arms reduction.

Third, in the era of so-called "alliance capitalism,"[2] corporations in the three countries need to pursue strategic technological partnerships (STP)[3] in response to growing technological interrelatedness and the need to acquire capabilities in related fields. In the 1980s, the increased adoption of STPs as a form of organized economic activity was seen as the main feature of a new phase in the capitalist system,[4] where competitiveness is increasingly pursued through cooperation. Growing numbers of technology based inter-firm alliances have been mainly recorded in science-based fields such as information communication technology (ICT).[5]

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2) M. L. Gerlach, *Alliance Capitalism: The Social Organization of Japanese Business* (Oxford: Oxford Univ. Press, 1992); J. H. Dunning, "Reappraising the Eclectic Paradigm in an Age of Alliance Capitalism," *Journal of International Business Studies*, Vol. 26, No. 3 (1995), pp. 461-491; J. H. Dunning, *Alliance Capitalism and Global Business* (London: Routledge, 1997).

3) For example, Hagedoorn pointed out the rationale of strategic technology partnering, discussing strategic technology alliances and modes of cooperation in high-technology industries. The same author also analyzed trends, networks and corporate patterns of non-core technologies during the 1980s. Duysters and Hagedoorn empirically investigated internationalization of corporate technology through strategic partnering. John Hagedoorn, "Understanding the Rationale of Strategic Technology Partnering: Internationalization Modes of Cooperation and Sectoral Differences," *Strategic Management Journal*, Vol. 14 (1993a), pp. 371~385; J. Hagedoorn, "Strategic technology alliances and modes of cooperation in high-technology industries," in G. Grabher, ed., *The Embedded Firm* (London: Routledge, 1993b); Geert Duysters and J. Hagedoorn, "Internationalization of Corporate Technology Through Strategic Partnering: an Empirical Innovation," *Research Policy*, Vol. 15 (1996), pp. 1-12.

4) *Supra note* 2.

5) Hagedoorn (1993b), *op. cit*.; J. Hagedoorn, J. Schakenraad, "Leading Companies and Networks of Strategic Alliances in Information Technologies," *Research Policy*, Vol. 21 (1992), pp. 163-190; G. Duysters and J. Hagedoorn, "Strategic Groups and Inter-firm Networks International High-tech Industries," *Journal of Management Studies*, Vol. 32, No. 3 (1995), pp. 359-381.

In light of the previously-mentioned facts, the purpose of this study is to analyze the trade and investment relationships of China-Korea-Japan and to suggest some ideas for their strategic alliance in the IT industry in an attempt to reconcile their chronic trade imbalance and frequent trade conflicts, thereby providing a foundation for an FTA in the future. For the above purpose, the paper briefly reviews trade structures and investment relationships among China, Korea and Japan. Also, it analyzes global trends in IT industry, general trends of ICT in Asian countries, and characteristics of China-Korea-Japan's strategic alliance in ICT. It also proposes some schemes for expanding the technological cooperation of the three countries in the IT industry.

ECONOMIC RELATIONSHIPS AMONG CHINA, KOREA AND JAPAN

Trade Structure of the Three Countries

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

China achieved high economic growth at an annual average rate of 10 percent in the 1990s, and its economic growth rates were 8.0 percent in 2000 and 7.3 percent in 2001. In particular, the Chinese manufacturing industry grew rapidly, at 8-10 percent annually during the last decade. To support high economic growth, since China needs a supply of many raw materials, electric and electronic parts, semiconductors and production facilities, and thanks to its geographic proximity to China's coast, Korea has increased its exports to China of raw materials and parts.

Current trade statistics show that the three countries have become major trade partners. Korea's exports to China were just US$ 2,654 million in 1992, but that figure had increased about nine-fold to US$ 23,754 million by 2002, and its imports to China recorded US$ 17,400 million in the same year. Japan's exports and imports to China also increased by 2.5 and 3.5 times, respectively, to US$ 4,980 million and US$ 7,728 million for the same period (1992-2002). As a result, in 2002, China ranked as the second export market (after the U.S.) for Korea, and the third source of Korea's imports after Japan and the U.S. In the same year, China also ranked as the second export market (after the U.S.) for Japan and the first source for Japan's imports. The three countries are among the top four trading partners for each other. According to China, in 2002, Japan and Korea were the third- and fourth-ranking export markets respectively, whereas Japan and Korea were the first and third sources, respectively, for China's imports.

Of the three countries, China's share of trade volume has rapidly increased, compared to the period before its diplomatic normalization with Korea in 1992 and Japan in 1995. China accounted for 9.5 percent of Korea's total export in 2000, ranking as the 3rd market for Korea's exports. However, in 2002, China accounted for 14.6 percent of Korea's total exports, ranking as the second market for Korea's exports, overtaking Japan's share of Korea's total exports. Meanwhile, China's share of Japan's total exports was 5.58 percent, ranking as the third market for Japan's exports in 2000, but it increased to 9.6 percent, ranking as the second market for Japan's exports in 2002. For China, Korea was the fourth source of its imports in 2000, but then became the third source after two years later.

As shown by Table 1, trade of manufactured goods among Japan, Korea and China has continued due to China's economic growth and industrial development. China has increased the portion of manufactured goods in exports to and imports from Korea and Japan. On the other hand, the portion of manufactured goods in Japan-Korea trade has shown a slight decline.[6]

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

(Unit: Percent)

		1991	1992	1994	1996	1998	2000	2002
Korea-	Export	86.9	90.8	89.2	87.2	85.7	86.3	91.0
China	Import	57.3	51.7	60.7	71.8	71.3	74.0	77.5
Korea-	Export	80.5	78.9	81.6	74.2	75.2	72.4	74.0
Japan	Import	95.6	95.7	96.0	95.8	95.3	95.6	94.9
Korea-	Export	94.7	94.3	94.5	93.0	93.2	93.4	n.a
Japan	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 belong to SITC 5-8 classifications. The portion of export is determined by each country's total amount of manufactured-goods exports divided by total export amount, while the portion of import is determined by each cuntry's total amount of manufactured-goods imports divided by total amount of imprt.

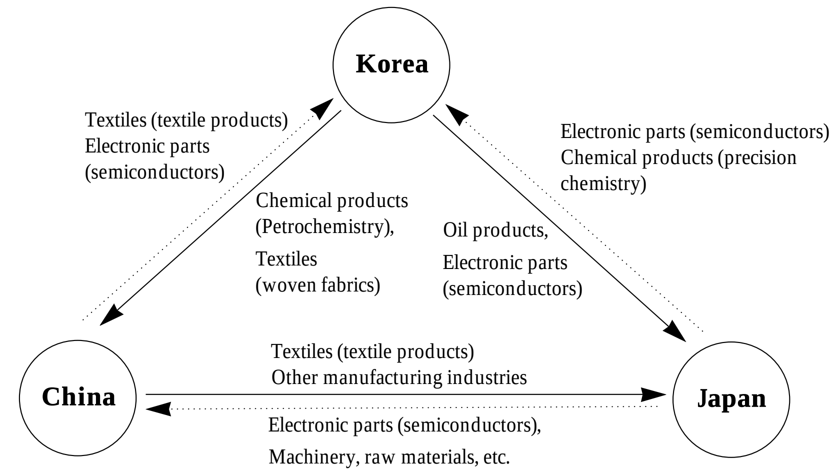
Source: Korea International Trade Association [www.kotis.net] and Japan External Trade Organization [www.jetro.or.jp]

As shown in Figure 1, Korea exports raw materials such as chemical products and textiles (woven fabrics) to China, and imports textile products and electronic parts (semiconductors) from China. Japan imports consumer goods from China, and exports capital goods such as electronic parts (semiconductors) and chemical products (precision chemistry) to Korea, and capital goods and raw materials to China.

Looking at the trade patterns between the three countries and the world, Korea and China import intermediary goods or capital goods mainly from Japan, Taiwan, and ASEAN countries. After processing

6) While Japan and Korea have remained important trading partners since the diplomatic normalization in 1965, bilateral trade showed a downward trend in the 1990s due to Korea's industrial development and trade diversification. Japan's share of 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.

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



and assembly, the two countries (Korea and China) export the processed or assembled commodities primarily to Japan or East Asia, while they export end products to the USA, Europe, and Japan. Korea ranks at the top in terms of dependence on 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 the USA. The top five trading countries of USA are those three, followed by Southeast Asian countries including Taiwan and Hong Kong. Trade with European countries as a percentage of the total trade of the three countries is relatively low, however, Japan, Korea and China both show a high concentration of their trade with the top 10 trading countries. Specifically, China's export and import concentration is 76.4 percent and 74.4 percent, respectively, indicating no diversification in import and export markets.

As shown by Table 2, a comparative view of the trade balance

Table 2. Trade Balance Among Japan, Korea and China

(Unit: US$ 100 million, 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	59.86
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.

among the three countries during the period of 1990-2002 (except the period before and after the Asian financial crisis in 1998) shows a very interesting phenomenon: Korea continued to record a deficit in trade with Japan, Japan continued to record a deficit in trade with China, and China continued to record a deficit in trade with Korea. Since 1993, Korea has been the major source of China's trade deficit, with the largest trade deficits in 2001 and 2002 in succession. The deficit has increased almost nine-fold for last 10 years, from US$ 740 million in 1993 to US$ 6,534 million in 2002. Just 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 diplomatic normalization in 1965.

Examining the trade structure of China-Korea-Japan in terms of the adjusted GL index ($\hat{GL}$),[7] we obtain the following results (see Table 3):

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7) When the calculated index of intra-industry trade is 0.75≤ (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, if the calculated index is out of the range above, it is considered as vertical intra-industry trade. A. Aquino, "Changes

First, horizontal intra-industry trade index has continuously increased in Japan-Korea, Japan-China, and Korea-China trade for most of the relevant years during the time period (1990-2002). While Japan has suffered from an 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.[8]

Second, the horizontal intra-industry trade index between Japan and Korea was highest most of the relevant years in the same period, followed by the Korea-China trade index and the Japan-China trade index, in order. However, the intra-industry trade index is relatively low in Japan-China trade since a large difference exists in the factor endowment in the two countries and their industries remain in quite different development stages. In contrast, in the case of Korea-China trade, the horizontal intra-industry trade has a relatively high portion since a small difference in factor endowment exists in the two countries and their industrial development stages are relatively closer.

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

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over Time in the Pattern of Comparative Advantage in Manufactures: an Empirical Analysis of the Period 1962-1974," *European Economic Review*, Vol. 15 (1981), pp. 41-62. The adjusted GL index ($\hat{GL}$)is calculated as follows:

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

8) For example, C. Aturupane, S. Djankov, and B. Hoekman, "Determinants of Intra-Industry Trade between East and West Europe," *Weltwirtschaftliches Archiv*, Vol. 135, No. 1 (1999), pp. 62-81.

Table 3. Intra-Industry Trade Index of the Three Countries

$\widehat{GL}$	Adjusted GL index ($\widehat{GL}$)of "horizontal" intra-industry trade			Adjusted GL index ($\widehat{GL}$) 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
1994	47.16	17.71	24.69	34.79	15.89	18.39
1996	51.53	28.72	32.49	43.09	23.74	21.20
1998	48.29	32.89	33.76	41.95	29.00	25.31
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.

Fourth, since the second half of the 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 did not show a big change in the same period, the portion of the horizontal intra-industry trade of total intra-industry trade might have relatively increased since the second half of 1990s. Consequently, it is expected that trade among the three countries will stress the differences in function and design of exporting commodies in the future.

Examining the 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 above Korea in terms of export coupling with the Japanese market. And Korea's export coupling with China is higher than Japan's export coupling with China. This suggests that Korea stood above Japan in terms of the export-based complementary relationship with the Chinese market.

Table 4. Export Coupling arnong Japan, Korea and China

Export Coupling[1)]	1997	2001
Japan's export coupling with Korea	1.85	1.86
Japna'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

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.

Investment Relationships

Overseas direct investment (hereinafter ODI) between the three countries looks somewhat unbalanced. As shown by Table 5, China is the second largest partner of Korea for total ODI as of June 2003. Korea's ODI to China reached US$ 6,673 million, 16.3 percent of Korea's total ODI, whereas its ODI to Japan recorded US$ 716 million, merely 1.8 percent of Korea's total ODI.

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

Examining the investment relationship between Japan and Korea, Japan was 11th among the ODI countries invested in by Korea, and the second largest investor to Korea after the US, as of June 2003. From the standpoint of Japan, Korea ranks 7th among the

Table 5. 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[2] (%)	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-Import Bank.

ODI countries that have been invested in by Japan and 16th among the FDI countries that have invested in Japan, respectively. The portion of Korea's direct investment to Japan still remains low, accounting for 1.9 percent of Korea's total ODI in 2000 and 2.5 percent 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 weakened competitiveness, the economic crisis, etc. But as the Korean economy recovered from the crisis, Japan's direct investments to Korea rebounded again after 1998. Then, Japan shared 15.4 percent 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, an attempt by Japanese companies to relocate their less-competitive manufacturing sectors overseas. However, along with the growing 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, and the same

Table 6. Japan and China' s FDI to Korea

(Unit: US$ million)

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 5.

pattern can be found in terms of Korea’s direct investments to China.

Korea’s investment in China skyrocketed after the establishment of diplomatic relations between the two countries in August 1992. During the 1990s, there was a wave of direct investments to China among Korean companies, with most of them concentrated in the manufacturing sector, especially on textiles, apparel, electronics, electronic equipment and components, among others. According to Chinese government statistics, Korea’s investment in China as a percentage of total foreign investment in China was 3.1 percent in

2001, ranking in the 7th place. More than 80 percent of Korea's ODI to China was concentrated in the manufacturing sector by 2002. This could imply that Korean companies' ODI to China is still motivated by lower labor costs.

Korea's investment in China showed rapid growth within a short period in the mid-1990s because its labor-intensive export industry (garments, shoes and electronic parts), which lost competitiveness in the export market due to the rise in domestic wages, moved its production base to China in order to take the advantage of the low wages. Korea's direct investment in China is characterized by investment led by small- and mid-sized companies in terms of investment target; investment for saving production costs 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 the manufacturing industry. Based on 2001 figures, the manufacturing industry, including garments, textiles, chemicals and electric and electronic products, as a percentage of Korea's investment in China, was 83.9 percent.[9] Investment is dominated by the manufactured goods for export to third countries, which covers textiles, garments, electric and electronic products, assembly metals, shoes and leathers using the cheap labor force. However, Korean firms' investment in Chinese non-manufacturing industries like construction, transportation and storage, and trade has recently increased.

Since China's accession to the WTO, the country has applied impartial treatment to the foreign companies invested in China, and opened investment in the service industry gradually, including the financial market. The Chinese government lifted the requirement on exporting products using China-made parts and equipoising the balance of exchange, all of which had been imposed upon foreign

9) The manufacturing industry as a percentage of Korea's overseas investment is only 50 %.

Table 7. Investment Coupling among Japan, Korea and China

Investment Coupling[1]	1997	2001
Japan's investment coupling wih 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	-	-

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

Source: Same as Table 4.

capital-invested companies. As service sectors like communication, distribution and tourism open gradually, investment in these industries will increase. Consequently, Korean direct investment in China is gaining new momentum. Indeed, Korean firms' investment in China has shown a definite recovery after that nation's accession to the WTO in 2001, which brought more autonomy and stability to investments.[10)]

Meanwhile, the investment complementarity relationship of the three countries can be measured in terms of investment coupling for the two years: 1997 and 2001(see Table 7). Japan's investment coupling with Korea was much higher than Japan's investment coupling with China. This suggests that the investment-based complementary relationship between Japan and Korea was higher than that between Japan and China.

10) It should be noted that improved conditions for foreign capital investment in China are helpful to Korean firms' investment in China but, from the global standpoint, Korea and China are in a heated race to attract more foreign capital. For details, see Lim Yang-Taek, *A Study on Technology Roadmap for the Industrial Competitiveness Improvement of Korean Promising Industries*, Hanyang University Reliability Analysis Research Center, (September 2003b).

TECHNOLOGICAL COOPERATION IN THE IT INDUSTRY AMONG CHINA, KOREA AND JAPAN

The Necessity

First of all, it is important to point out the necessity for technological cooperation in the IT industry among Japan, Korea and China for 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 a surplus in trade with China, with China's continued surplus in trade with Japan, and Japan's continued surplus in trade with Korea.

Second, the trade structure between Japan and Korea is limited to a few selected commodies such as machinery, and electric and electronic products. The trade structure between Korea and China is also limited to a few selected commodities. Such a concentration on these 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 about frequent trade conflicts (e.g. the trade dispute on garlic in June 2000). Korea has so often been confronted with fastidious non-tariff barriers (hereinafter NTBs) in China, for example, anti-dumping or embargo for major exporting goods.[11] From 1997 to 2002, China brought 18 cases of anti-dumping issues before the courts. Korea was involved

11) In analyzing the structural change in the Korean commodities exported to China, special attention should be paid to the following characteristic. The majority of Korean products exported to China have increased their dependence on the Chinese market, and have been designated as primary targets of Chinese import restrictions. In 2001, Korean export articles with high dependence on the Chinese market were organic chemical products (43.8 % of total export), leather and

in 14 cases, and became the most frequently appealed country followed by Japan's nine cases and the U.S.'s seven cases. In addition, Korea's major export items to China had been concentrated on the less-competitive industrial sectors of China, including petrochemicals, iron and steel before 2001. These industrial sectors consist of Chinese national enterprises, which are, for the most part, less competitive in world markets. Therefore, the Chinese government tried to protect domestic companies by using various NTBs. We can expect that this Chinese policy will continue for a while even though China has 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 in IT (rather than vague economic cooperation) would be a wise solution to the aforementioned problem, either actual or potential, now and in the future. The author has suggested some recommendations for technological cooperation between Korea and Japan in an attempt to reduce Korea's chronic trade deficit with Japan[12] and for the same cooperation between Korea and China in an attempt to resolve their trade disputes.[13] However, such attempts are confined to the bilateral economic relationship, not the tripartite relationship.

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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 anti-dumping targets by China. For details, see Lim (2003b), *op. cit*.

12) Lim Yang-Taek, "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 in Seoul (July 31-August 4, 2004a).

13) See, Yang Taek Lim, "Korea-China Industrial and Technological Cooperation and Further Development Strategy," *Journal of Asian Economics*, Vol. 14, No. 2 (March/April 2003c); and Yang-Taek Lim, "Korea-China Technological Cooperation," *Asian Economic Cooperation in the New Millennium* (World Scientific Publishing, 2004b), [http://www.wspc.com.sg/books/economics/aeiede.shtml].

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.[14] However, this study of the three countries' technological cooperation is confined to their regional cooperation on IT, and does not cover globalization of general S&T, research, or specific innovation.

Strategic Considerations for Technological Cooperation

International industrial/technological cooperation can be motivated by distribution of risk and financial burden, acquisition 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 categories: capital cooperation, production cooperation, marketing cooperation, technology cooperation, and R&D cooperation.[15]

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14) For example, W. B. Walker, *Industrial Innovation and International Trading Performance* (Greenwich: JAI Press, 1979); B. Balassa, "The Changing Pattern of Comparative Advantage in Manufactured Goods," *Review of Economics and Statistics*, Vol. 61 (1979), pp. 259-266; K. Pavitt and L. Soete, "Innovative Activities and Export Shares: Some Comparisons between Industries and Countries," in K. Pavitt, ed., *Technical Innovation and British Economic Performance* (London: Science Policy Research Unit, Macmillan, 1980); C. D. Le, "The Role of R&D in High-Technology Trade: an Empirical Analysis," *Atlantic Economic Journal*, Vol. 15 (1987), pp. 32-38; H. Grupp, "Innovation Dynamics in OECD Countries," in *OECD, Technology and Productivity: The Challenge for Economic Policy* (Paris: OECD, 1991); and Peter L. Danniels, "National Technological Gaps and Trade: an Empirical Study of the Influence of Globalization," *Research Policy*, Vol. 25 (1997), pp. 1189-1207.

Particularly, technology cooperation includes technology grant agreement, mutual technology grant agreement, technology sharing agreement, technology support agreement, second sourcing, technology trade, etc. Technology cooperation is divided into two categories: vertical cooperation and horizontal cooperation, depending on the cooperation contents. The former is mainly used for acquiring technical competency of a cooperation partner. This can be illustrated by cooperation in scientific equipment for development of superconductors, home appliances, electric motors and electronic parts. The latter is made primarily for market access. This 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")[16] is used broadly to encompass the panoply of cooperative arrangements between different businesses firms created for more than individual transactions. For example, Gutterman[17] 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 out that commercialization of new products and technologies usually require 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[18] explored some trends in the

15) Lim (2003a, b and c), *op. cit*.
16) For example, *supra note* 3; Grazia D. Santangelo, "Corporate Strategic Technological Partnerships in the European Information and Communications Technology Industry," *Research Policy*, Vol. 29 (2000), pp. 1015-1031.
17) Alan S. Gutterman, *The Law of Domestic and International Strategic Aliiances: A Survey for Corporate Management* (Westport, CT : Quorum Books, 1995).

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 the "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 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

18) Duysters and Hagedoorn (1996), *op. cit*.

global strategy, still with sufficient scale effects and ample opportunities for capitalizing on regionally available technological competences.

Therefore, international technological cooperation needs to be expanded in terms of target technology, target country or institutes, methods or means, and negotiation power, among others. Lim[19] suggested that some strategic consideration for international industrial/technological cooperation, be given to the following three factors: (1) Needs (which technology is needed at the time?), (2) Resources (which resources are necessary for absorbing and improving imported technologies?), and (3) System (which institutional mechanism is necessary for making, organizing, using and developing state-led technology cooperation policy?).

Archibugia and Pietrobelli[20] presented taxonomy of the globalization of technology with some evidence on global technological and scientific collaborations, and summarized strategies for developing countries to access and use international know-how (see Table 8).

Figure 2 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.

Meanwhile, Lal[21] 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

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19) Lim, *supra note* 10 and 13.

20) Daniele Archibugi and Carlo Pietrobelli, "The Globalization of Technology and Its Implications for Developing Countries: Windows of Opportunity or Further Burden?" *Technological Forecasting and Social Change*, Vol. 70 (2003), pp. 861-883.

21) K. Lal, "Determinants of the Adoption of Information Technology: A Case Study of Electrical and Electronic Goods Manufacturing Firms in India," *Research Policy*, No. 28 (1999), pp. 667-680.

Table 8. 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 wiht 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 stragegies 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, *supra note* 20.

Figure 2. Main Success Factors

Imitation	• 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 Selection	• 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 andinformation 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 rist/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
	Structure	Culture	Risk

Cooperation Success

Source: Adapted from Christian Marxt and Patrick Link, "Success Factors for Cooperative Ventures in Innovation and Production Systems," *International Journal of Production Economics*, Vol. 77 (2002), pp. 219-229.

be determined by variables such as entrepreneurship, skill intensity, government policy, openness of the 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 adoption.

China- Korea-Japan Strategic Alliance in the IT Industry

Regarding the three Northeast Asian countries, discussion of FTA and various forms of regional cooperation, it is necessary to have a joint strategy for building a digital network in line with the growth and expansion of strategic alliances in the IT industry. It should be noted that an efficient logistics flow is indispensable for a success in a digitalization growth strategy. Due to the attributes of a network economy, as more countries are linked, synergic effects will increase. Accordingly, 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 could only rely on the statistical data published in daily newspapers and business magazines for the last three years (2000-2002). Table 9 shows the characteristics of strategic alliances in the IT industry among Korea, China and Japan.

First, Asia has increased its portion of strategic alliances in the world ICT industry. Korea shows the highest number of strategic alliances in Northeast Asian countries, followed by Japan and China, respectively. However, the portion of strategic alliances in the IT industry of the three countries decreased between 2001 and 2002, reflecting the slump in the IT industry. During the same time, Korea's portion decreased from 66.7 percent to 47.1 percent, China's decreased from 52.7 percent to 49.3 percent, and Japan's decreased from 33.1 percent to 26.0 percent. As the figures indicate, Korea was most influenced by the slump. Moreover, Korea's number of total strategic alliances 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 alliances in the IT industry was 51.1 percent in Japan, 32.9 percent in China, and 28.8 percent in Korea, whereas the portion of

Table 9. Trend in the Strategic Alliance in the IT Industry by Korea, China and Japan and Outlook (Unit: Case, Percent)

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

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

joint R&Ds was 21.7 percent in Japan, 13.8 percent in Korea, and 8.7 percent in China in the same industry. Japan's portion of technology-related strategic alliances in the IT industry and that of joint R&Ds in the same industry were highest in 2001. The previously described observation indicates the generally recognized technology differences among the three countries. China and Korea rely more on technology licensing than on R&D, China prefers the former.

Third, examining the change in the pattern of their technology alliances between 2001 and 2002, China's technology licensing alliances increased but both Korea's and Japan's decreased, whereas joint R&Ds of the three countries increased. This may imply that their strategic alliances in the IT industry have shifted away from technology license alliances to joint R&Ds. This shift can be seen as desirable, since it indicates that the three countries are not satisfied with using already-developed technologies but prefer to invest in R&D on new IT technology.

As shown by Table 10, the portion of strategic alliances among Korea, China and Japan was higher than that of strategic alliances with countries other than USA for the years: 2000-2002.[22] It seems that strategic alliances among the three Asian countries were considered important in themselves. China preferred strategic alliances with large Korean companies, while Korea made strategic alliances with large Japanese companies. On the contrary, large Japanese companies had a competitive advantage over, or a preference for Korean venture businesses, while large Korean companies had a competitive advantage over, or a preference for a variety of companies in China.

Most strategic alliances between Korea and China were made between large Korean companies and Chinese counterparts for the purpose of introducing knowledge, technology, and capital. Their primary target business categories were communication equipment

22) Korea, China and Japan are the second-place strategic alliance partners of the USA.

Table 10. Trend in Korea-China-Japan Strategic Alliance and Its Outlook (Unit: Case, Percent)

		2000	2001	2002	Remarks	Outlook
The number of strategic alliances between 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 alliances between 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

1) The figures in the parentheses are percentages of the total number of strategic alliances.

and their parts, internet business, content, solution, and software development. The highest portion was taken by strategic alliances of large companies specialized in producing communication equipment and providing IT service. The major portion of 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 alliances with Korea.

On the other hand, the strategic alliances between Korea and Japan were dominated by the alliance of Korean venture businesses (dotcoms showing a comparative advantage in solution or software) and large Japanese companies in the IT industry. The greatest number of technology-related strategic alliances in the same industry were between Korean IT companies and Japanese counterparts. Korea's strategic alliances with Japan in the same industry had a very low portion of joint ventures, unlike its strategic alliances with China. If Korea and Japan sign an FTA in the near future,[23] their strategic alliances will evolve more vigorously than Korea-China strategic alliances in the same industry.

In connection with the preceding expectations, 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 semiconductors from Korea increased by 56.1 percent while its total import from Korea increased by only 6.2 percent, in spite of the recent IT recession the fall of semiconductor prices in 2001. In 2001, DRAM occupied the dominant share of Japan's import of semiconductors 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 has now taken a foothold in the Japanese semiconductor market.[24]

23) For details, see Lim (2003a), *op. cit*.

24) Lee and Lim 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. Keun Lee and Chaisung Lim, "Technological Regimes, Catching-up and Leapfrogging: Findings from the Korean Industries," *Research Policy*, Vol. 30 (2001), pp. 459-483.

CONCLUDING REMARKS

For the last ten years or more, trade among Japan, Korea and China has recorded explosive growth due to many factors, including China's high economic growth at an annual average of 10 percent and steady economic liberalization, and the three countries' geographic closeness and complementary industrial structures. In terms of current prices, the volume of trade among the three countries jumped from US$ 41,820 million to US$ 189,120 million in 2002, at a much faster speed than the average growth rate of world trade. If the Japanese economy escapes from the dark tunnel of recession that has lasted for a last decade, its imports from Korea and China would increase, and division of labor between Korea and Japan would be deepened.

However, the three countries' trade volume recorded 18 percent in 2000, compared to NAFTA (56%) and 15 EU countries (62%).[25] Moreover, according to a survey by the Korea Institute for Industrial Economics & Trade (KIET), low-level technology industry as a percentage of total intra-industry trade among the three countries has been highest, and the portions of medium-and-high-level technology industry (10-15%) and high-tech industry (10%) are falling.

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 in vitalizing the regional trade among the three countries and formed a highly complementary trade pattern based on each country's own comparative advantage over other trading partners.

25) Lim (2001), *op. cit*.

The growth of portion of the manufactured goods in China's trade with Korea and Japan has accelerated the 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 grown continuously, with the major determinants assessed to be per-capita GDP and the ratio of manufactured export goods to total export of each country. 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 the vertical intra-process division of labor together with the horizontal product-differentiated division of labor. Due to the technological gap between Japan and the other two countries, Japan specialized in upper production processes and high-end, non-universal products, whereas Korea and China specialized in lower production processes and low-end, 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 supplanted final products among trade goods, which, in turn, have provided 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 host countries and between the parent firms and their partners in Japan have taken an increasingly larger share through Japan's direct investments to China and Korea and its strategic alliance with the other two partners.

Strategic alliances in Northeast Asia are expected to grow much faster than in other regions in the period up to 2010, now that China belongs to the WTO. Its economic take-off along with the 2008 Beijing Olympics, Japan's escape from a long-term economic slump, and visible economic cooperation in Northeast Asia will exert combined influences. And there have been a few multilateral strategic alliances involving all three Northeast Asian countries.

Examining the 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 stood higher above Korea in terms of export coupling with Japanese market. Korea's export coupling with China was higher than Japan's export coupling with China. This suggests that Korea stood above Japan in terms of export-based complementary relationship with the Chinese market. Meanwhile, Japan's investment coupling with Korea was much stronger than Japan's investment coupling with China. This implies that the investment-based complementary relationship between Japan and Korea was stronger than the relationship between Japan and China. The preceding analysis indicates that Korea can act as a bridge for economic cooperation between the three countries in terms of a higher export-based complementarity relationship between Korea and China and a higher investment-based complementarity relationship between Korea and Japan.

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. Information order is most needed today due to the huge cultural diversity in the Asia-Pacific region, and this should be established by developing a plan to eliminate the digital gap in the 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 between private companies in the IT industry are more close-knit, it would be a win-win strategy giving benefits to all the three countries. The NAITC would mean a regional economic cooperation body operating a common program for developing technologies and services of IT and eliminating the digital gap among Northeast Asian countries.

The establishment of an information order in the region can be also 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 easily build a digital network, and it will further enable the three countries to enhance their negotiation power to cope actively with digitalization in the world economy. For instance, 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, IT technology standardization is indispensable not only for the three countries, but for the world.

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 IT technology standards.[26] A joint body between the private sector and the government should also provide services like information, consulting, training, contract support, and help in dispute resolution. It should be also noted that despite the increased demand for technological cooperation among the three countries, an S&T cooperation body has never been formed. Therefore, we may refer to the European S&T collaboration body, EUREKA and COST[27] in an attempt launch an Northeast Asian IT community (NAITC) and Northeast Asian technology community

26) Of course, the government's direct intervention should be minimized, and they should provide indirect support in consideration of the WTO rules.

27) COST (European Cooperation in the field of scientific and technical research) is the longest running framework for research cooperation in Europe, having been established in 1971 by a Ministerial Conference attended by Ministers for Science and Technology from 19 countries.

(NATC) to launch in the region.

Finally, the author would like to close with a sincere observation about the future of Asia in conjunction with the importance of China-Korea-Japan's strategic alliance in the IT industry[28]: Because industrialization in Asia came later than in the West, Asia was relatively backward and most Asian countries were colonies of the West. The same principle holds true today. The information drive in Asia started later than in the West, and if Asia does not strive to catch up, it could fall again into relative backwardness and become a colony of information.

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