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A Review on Korea, China and Japan's Comparative Advantage in the IT Services Sector: Focusing on Productivity Analysis

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The IT Services Sector in Korea, China and Japan

An analysis of the share of the IT services sector as a percentage of national GDP in Korea, China and Japan reveals that Japan has the highest share, and China the lowest. Even limiting Japan's IT services sector to information services (IT services, software, etc.), the share is close to 3 percent of total GDP, while in the case of China, despite the generous inclusion of the vast information and communications industry the sector still only reaches 2.07 percent of overall GDP. Nevertheless, according to relevant statistics provided by IDC (2012) and others, growth in the Japanese IT services market remains stagnant, while in Korea and China the market is expanding at a relatively swift pace, at 5 percent and 8 percent, respectively.

Table 1. Market size of Software in major countries (as of 2011)

Rank	Country	Market Size (USD 100Mn)	Share	YoY Growth	Annual Agv. Growth Rate (07-11)
1	US	3,794.70	38.80%	5.70%	3.30%
2	Japan	896.4	9.20%	-1.20%	-1.10%
3	UK	700.6	7.20%	1.10%	1.60%
4	Germany	614.8	6.30%	3.80%	2.20%
5	France	477.3	4.90%	3.20%	1.40%
6	Canada	298.3	3.10%	4.60%	3.10%
7	China	227	2.30%	11.90%	8.00%
8	Italy	223.6	2.30%	4.30%	4.30%
9	Australia	218.3	2.20%	13.60%	11.30%
10	Brazil	216.2	2.20%	-0.90%	-0.60%
17	Korea	94.2	1.00%	6.00%	5.60%
Global (Total)		9,778.50	100.00%	4.60%	3.00%

Note: Software = Package Software + IT services.
Source: IDC (AUG 2012), Secondary source citation: Korea Electronics Association (2012).

A closer look into market structure shows that in all three countries, SI (system integration) accounts for the largest share of IT services, followed by the IT outsourcing sector. Korea and China displayed a higher percentage of IT outsourcing compared to Japan. In all three countries, a small number of large conglomerates led the market, but they were outpaced by SMEs in number. The 'big 3' in Korea are Samsung SDS, LG CNS and SK C&C; Japan is also marked by a dominance of a few large companies such as NTT Data.

Meanwhile the ICT services sector, which includes communications, only accounts for a small part of trade and investment in Korea, China and Japan[1)] As of now it is not an option to separate data for the IT services sector in trade and investment, aside from Korea's FDI statistics. In terms of investment, FDI in Korea's IT services sector is more centered on Outward-FDI rather than Inward-FDI, and about 50 percent of this Outward-FDI is focused on investment in China. As for Inward-FDI, most investment is directed toward the software industry (in Korea FDI statistics, software industry is included in the IT service sector) and most of this investment comes from Japan.

According to an input-output analysis, in all three countries the IT services sector showed a relatively weak forward and backward linkage effect compared to other industries, particularly in the case of the former. This can be attributed to the IT services sector's character, but also to the fact that the evolution of a service economy and the advancement of the IT services sector opens up more possibilities for IT services to gradually become intermediary goods in other industries rather than final goods.

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Analyzing the Productivity of the IT Services Sector in Korea, China and Japan

Given that the IT services sector lacks background information on the price of production factors, this study used DEA (data envelopment analysis) methodology to analyze productivity.

Comparing the national average of the inter-firm relative efficiency index as of 2012, as seen in Table 2, Korean companies had the highest average efficiencies in all criteria, followed by Japanese and then Chinese companies. Of particular note was that Chinese companies displayed a relative efficiency half that of Japanese companies as of 2012. As seen in Table 3, inter-firm deviation of the efficiency index was largest in Korea.

Table 2. Average efficiency index of China, Japan and Korea

	CRS TE	VRS TE	SCALE
Korea	0.357636	0.448566	0.813404
China	0.149111	0.216236	0.745028
Japan	0.285313	0.387524	0.762948

Note: CRS TE = technical efficiency from CRS DEA.
VRS TE = technical efficiency from VRS DEA.
SCALE = scale efficiency = crste/vrste.
Source: Compiled by author based on analysis results.

Table 3. Summary statistics of efficiency index

		Average	Standard Deviation	Minimum Value	Maximum Value
Korea	CRS TE	0.357636	0.208055	0.046	1.000
	VRS TE	0.448566	0.261571	0.052	1.000
China	CRS TE	0.149111	0.077632	0.010	0.390
	VRS TE	0.216236	0.158690	0.027	1.000
Japan	CRS TE	0.285313	0.131023	0.056	1.000
	VRS TE	0.387524	0.187482	0.103	1.000

Source: Compiled by author based on analysis results.

Korea also turned out to have a much higher efficiency index in companies employing 500 and over compared to China or Japan. The figures recorded approximately 8 percentage points over average under the CRS assumption and roughly 14 percentage points above average under the VRS assumption; in China, efficiency was consistent regardless of company size, and Japan, also, only listed efficiency figures of 1 to 5 percentage points above average in companies employing 500 and over.

Table 4. Efficiency index by company size

		CRS TE	VRS TE	SCALE
Korea	Average of 99 companies	0.357636	0.448566	0.813404
	Average of 29 companies employing 500 and over	0.438034	0.586759	0.756310
China	Average of 144 countries	0.149111	0.216236	0.745028
	Average of 111 companies employing 500 and over	0.146676	0.214676	0.725144
Japan	Average of 288 companies	0.285313	0.387524	0.762948
	Average of 132 companies employing 500 and over	0.293098	0.433909	0.698402

Source: Compiled by author based on analysis results.

In addition, the national average of the total factor productivity (TFP) change index[2] for 2012 compared to 2000 under the Malmquist productivity growth index analysis was the highest in China at 1.67, while Korea and Japan recorded comparatively lower productivity improvement levels at 1.08 and 1.04, respectively. This implies that overall, productivity gaps between the three countries are narrowing.

Taking the TFP change index apart into the technical efficiency change index[3] and the technical change index, the average technical change index for all three countries was mostly lower than 1. Through this, it can be inferred that productivity improvement induced by the increase of the efficiency frontier value within the analyzed target group was close to none or even undermined. By contrast, the impact from an increase in technical efficiency change was relatively strong. [4]This implies that the reduction of the gap between the group's efficiency frontier value and overall efficiency greatly influences the expansion of average productivity. This can be interpreted as the TFP change index being induced by a catch-up effect between nations rather than technical progress across the industry in general.

Table 5. Productivity change index in 2012 of China, Japan and Korea (compared to 2000)

	Technical efficiency change index	Pure technology efficiency change index	Scale efficiency change index	Technical change index	TFP Change Index
Korea	1.124737	1.219158	0.917237	0.948105	1.079711
China	1.878632	2.418526	0.800423	0.911421	1.671158
Japan	1.241392	1.297333	1.026186	0.842559	1.036480

Note: 1) Technical efficiency change index = pure technology efficiency change index*scale efficiency change index.
2) TFP change index = technical efficiency change index*technical change index.
3) Converted into constant prices (as of 2000) via national GDP deflators for comparison.
Source: Compiled by author based on analysis results.

Institutional Conditions related to the IT Services Sector in Korea, China and Japan

A close look into institutional conditions that affect the productivity of the IT services industry in Korea, China and Japan revealed that five conditions can prove to be excessive regulations on IT services companies.

The first that can be pointed out is legal or regulatory conditions that came into effect as a result of the adoption or development of legislation related to new ICT (information

2) The change index value indicates the productivity level of the year compared to baseline year; the value is 1 if productivity levels are equal

3) The technical efficiency change index is a conceptual value showing how much closer the observed value at a certain point has become to the production frontier compared to a previous point in time. This can therefore be interpreted as a representation of the catch-up effect.

4) The technical change index is an assessment of the increased value of the production frontier at a certain point compared to a baseline point in time. This can therefore be interpreted as an assessment of technology advancement levels within an industry (analyzed industries in general).

and communications technology) introduction. In Korea, regulations involving cloud computing development were viewed to fall in the category of excessive, while China was considered to be restricting foreign business activities by treating new ICT services like cloud computing as value added services. It was also suggested that Japan adopt the principle of nondiscrimination between data services being offered home and abroad with regard to cloud computing.

The second observation was that existing legislation may serve as excessive regulation in the IT services market in each country. In Korea, the issue was the restriction on saving map data on non-Korean servers; in China, regulations on services providing internet contents and the Chines network being closed off to foreign companies were pinpointed; and in Japan, the issue lay in unnecessary regulations adopted as a result of the enforcement of personal data protection law.

The third condition pointed out was institutional transparency on the part of the government. It was suggested that in China, the problem lies with internet censorship and service regulations being undisclosed and executed in an inconsistent manner. Meanwhile in Japan, the transparency problem lay in the adoption and execution of government policy involving the IT services sector.

Fourth, there were views on government policy excluding technology neutrality, international standards, interoperability of data processing; it was noted that in Korea and China, public sector contracts employed policies preferential to domestic technology that disregard international standards. On the same issue in Japan, there was practice of a lack of compliance with technology neutrality, international standards and interoperability. There were also observations that these were lacking in policies related to cloud computing and health IT.

Fifth and finally, an excessive regulatory environment induced by bureaucracy was pointed out in Japan, where Japan's bureaucratic distribution structure could restrict a level playing field for the IT services sector.

Implications

Korea, China and Japan are all pushing aggressively for policies fostering IT services, and factoring in the potential for IT services to be utilized in various fields, the IT services sector in all three countries have a positive outlook for future advancement. Especially in Korea and China, in relative proportion to Japan, the forward linkage effect of the IT services sector – in other words, the utilization of IT services in production in other fields – is considerably lower than the industrial average. It can therefore be anticipated that IT services in Korea and China have potential for more utilization to a broader extent. However, it was analyzed that in all three countries institutional conditions pose a significant impact on productivity levels as well as the vitalization of trade and investment. Thus, discussions on trilateral cooperation in the IT services sector must not only include the improvement of technology competitiveness and productivity, but also institutional enhancements such as the relaxation of entry barriers.

Drawing from the above research, the policy implications for boosting cooperation between Korea, China and Japan are as follows. First, closer cooperation between the three countries in IT services requires efforts in compiling background data for the purpose of comparing productivity. Due to the limited scope of information used in this study, productivity comparisons were based on company financial data that was used to assess relative efficiency

between companies. In much of the IT services sector a sizeable portion of work is outsourced, and this should be taken into account for a more accurate analysis of company productivity. Thus, the three countries should cooperate in building a common data set for productivity analysis. Second, there is a necessity to harness the varying levels of IT services development in each country to encourage cooperation between Korean, Chinese and Japanese companies. Although the three countries do commonly share key strengths in IT services, Korea is considered to be more competitive in technology, Japan in contents and China in the market and hardware. This means that the companies in the three countries have much to gain in synergy through mutual cooperation, and to this end it will be necessary for the government to support private sector cooperative projects through the facilitation of government-level consultative groups. A policy priority in the three countries could be to lower the entry barriers mentioned above so as to encourage cooperation that utilizes the comparative advantages of the countries involved. Thirdly, all three countries must make concerted efforts to improve industrial competitiveness, for instance by strengthening SME competitiveness and fostering professional talent. With regard to professional IT services manpower, it is especially important to upgrade the expertise of middle management. According to the productivity analysis on Korea, China and Japan, the overall productivity (efficiency) shift was affected more by the catch-up effect between companies rather than technology advancement. In other words, technology advancement in the IT services sector itself was insignificant. Compared with examples of advanced countries like the US, there was a considerable lack of middle management with sufficient work experience. This calls for a system focused on training professional talent. KIEP