

# Technology Transfer in Pacific Region

*Impact of technology transfer on national security and economic development is examined*

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It has been nearly two decades since Korea launched its First Five-Year Plan in 1962. At present, Korea has almost completed its Fifth Five-Year Plan, which began in 1982. The period from 1972-1978 was a turbulent but exciting one during which the emphasis was on developing heavy and chemical industries that required an enormous amount of capital investments. However, Korea has never altered its main theme of sustaining the growth of the economy through an export-oriented economic policy.

Successful execution of the policy, however, depended very heavily on the active trade among the Pacific Basin countries, the existence of peace in the region for a relatively long period of time, and sustained efforts on the part of industry to upgrade its industrial skills. Although the credit is often given to the existence of a hard-working, literate population in Korea for the successful growth of the Korean economy, trade, peace, and technology were important factors in the achievement.

## TRADE PATTERNS

The economic interdependencies of the market economies of the Pacific Basin are well examined and described by Dr. Hahn-Been Lee in his excellent paper entitled, "Korean Development in the Context of the Pacific Momentum."<sup>1</sup> As Table 1 shows, while the United States was the major market for exports for six countries (Japan, Canada, Korea, Taiwan, Hong Kong and Indonesia), Japan also was an export target for another seven (the United States, Canada, Australia, Korea, Taiwan, Malaysia, and Indonesia). At the same time, all the countries mentioned above imported about equal amounts of material from the United States and Japan. The Pacific Basin, therefore, is a bipolar trading bloc in which major trade routes radiate to and from the United States and Japan. Although the given data are somewhat old, updating of the data is not likely to change the pattern.

Another observation has to do with the dynamic growth in East Asia. Japan is continuing its relentless export drive while other East Asian nations like Korea, Taiwan, and Hong Kong are recording remarkable resiliency despite the past oil shocks and the protectionist mood of the developed nations. Similar growth patterns are observed in Southeast Asia and Oceania,

**THE TRADE MATRIX FOR PACIFIC BASIN COUNTRIES IN 1980**  
(UNIT: MILLION OF US \$, F.O.B.)

FROM	TO	U.S.	CANADA	JAPAN	AUSTRA- LIA	NEW ZEALAND	KOREA	TAIWAN	HONG KONG	PHILIP- PINES	THAI- LAND	MALAY- SIA	SINGA- PORE	INDO- NESIA	SUB- TOTAL	REST OF WORLD	TOTAL	EXPORT WITHIN PACIFIC (%)
U.S.			35,395	20,790	4,876	38	4,685	4,673	2,686	1,999	1,263	1,337	3,033	1,545	82,320	138,383	220,703	37.3
CANADA		41,065		3,751	576	96	355	249	169	94	119	82	171	137	46,864	20,663	67,527	69.4
JAPAN		31,905	2,449		3,407	680	5,393	5,353	4,784	1,692	1,925	2,070	3,929	3,476	67,063	63,397	130,460	51.4
AUSTRALIA		2,579	470	5,871		1,043	486	512	330	192	159	507	538	370	13,057	9,004	22,061	59.2
NEW ZEALAND		721	118	680	712		57		79	74	34	70	83	76	2,704	2,703	5,407	50.0
KOREA		4,624	345	3,039	230	28		209	823	153	165	184	267	366	10,433	7,072	17,505	59.6
TAIWAN		6,760	460	2,173	539		267		1,551	195	176	168	545	478	13,312	6,499	19,811	67.2
HONG KONG		5,157	394	909	477	61	227	250		328	213	176	863	617	9,672	10,052	19,724	49.0
PHILIPPINES		1,533	64	1,511	98	4	203	117	190		63	90	112	107	4,142	1,569	5,711	72.5
THAILAND		795	22	994	69	6	59	90	311	21		280	482	317	3,446	3,509	6,505	53.0
MALAYSIA		2,117	63	2,961	185	55	261	424	243	196	188		2,477	34	9,204	3,801	13,005	70.8
SINGAPORE		2,424	132	1,560	780	351	289	222	1,496	273	844	2,908			11,279	8,098	19,377	58.2
INDONESIA		4,605	24	11,036	411	104	377	540	133	192	39	76	2,708		20,245	2,319	22,564	89.7
<b>SUBTOTAL</b>		<b>104,335</b>	<b>39,936</b>	<b>55,275</b>	<b>12,360</b>	<b>2,466</b>	<b>12,659</b>	<b>12,639</b>	<b>12,795</b>	<b>5,409</b>	<b>5,188</b>	<b>7,948</b>	<b>15,208</b>	<b>7,523</b>	<b>293,741</b>	<b>276,619</b>	<b>570,360</b>	<b>51.5</b>
REST OF WORLD		148,660	22,630	86,009	9,819	3,006	9,630	7,094	9,608	2,776	4,026	2,892	8,805	4,857	319,812	965,528	1,285,340	
<b>TOTAL</b>		<b>252,995</b>	<b>62,566</b>	<b>141,284</b>	<b>22,179</b>	<b>5,472</b>	<b>22,289</b>	<b>19,733</b>	<b>22,403</b>	<b>8,185</b>	<b>9,214</b>	<b>10,840</b>	<b>24,013</b>	<b>12,380</b>	<b>613,553</b>	<b>1,242,147</b>	<b>1,855,700</b>	
IMPORT WITHIN PACIFIC (%)		41.2	63.8	39.1	55.7	45.1	56.8	64.1	57.1	66.1	56.3	73.3	63.3	60.8	47.9			

Table I

\*Head of Korea Technical Advancement Corporation; paper reprinted with permission from the National Defense University Press Publication, "Economics & Pacific Security, The 1986 Pacific Symposium."

making the entire Western Pacific region a promising growth center. Trade from the United States has also gravitated toward the Pacific. By the latter half of this decade, U.S. trans-Pacific trade should exceed the trans-

## TECHNOLOGY TRADE OF DEVELOPED COUNTRIES, 1965-1981

(\$ US MILLION)

YEAR	JAPAN			UNITED STATES			UNITED KINGDOM			FEDERAL REPUBLIC OF GERMANY			FRANCE		
	REC- EIPTS (A)	PAY- MENTS (B)	A/B (%)	REC- EIPTS (A)	PAY- MENTS (B)	A/B (%)	REC- EIPTS (A)	PAY- MENTS (B)	A/B (%)	REC- EIPTS (A)	PAY- MENTS (B)	A/B (%)	REC- EIPTS (A)	PAY- MENTS (B)	A/B (%)
1965	17	166	10.2	1,534	135	1,136.3	138	131	105.3	75	166	45.2	169	215	78.6
1966	19	192	9.9	1,514	140	1,081.4	168	143	117.5	73	175	41.7	181	244	74.2
1967	27	239	11.3	1,746	166	1,051.8	183	174	105.1	90	193	46.6	195	230	84.8
1968	34	314	10.8	1,867	186	1,003.8	211	195	108.2	99	219	45.2	270	282	95.7
1969	46	368	12.5	2,019	221	913.6	218	223	97.8	98	256	38.3	336	332	101.2
1970	59	433	13.6	2,331	225	1,036.0	273	255	107.1	119	306	38.9	344	357	96.4
1971	60	488	12.3	2,454	241	1,056.0	288	270	106.7	149	377	39.5	398	467	85.2
1972	74	572	12.9	2,770	294	942.2	339	307	110.4	201	433	46.4	585	587	99.7
1973	88	715	12.3	3,226	386	835.8	410	350	117.1	216	539	40.1	835	741	112.7
1974	113	718	15.7	3,821	346	1,104.3	465	413	112.6	262	582	45.0	980	823	119.1
1975	161	712	22.6	4,300	473	909.1	493	484	101.9	308	729	42.3	1,313	1,035	126.9
1976	173	846	20.4	4,353	482	903.1	601	477	126.0	289	692	41.8	1,438	1,180	121.9
1977	233	1,027	22.7	4,724	447	1,056.8	632	518	122.0	335	816	41.1	1,775	1,239	143.3
1978	274	1,241	22.1	5,869	610	962.1	744	625	119.0	430	964	44.6	2,053	1,663	123.5
1979	342	1,260	27.1	6,189	706	876.6	—	—	—	491	1,065	46.1	—	—	—
1980	378	1,439	26.3	6,860	768	893.2	—	—	—	—	—	—	—	—	—
1981	537	1,711	31.4	7,096	883	803.6	—	—	—	—	—	—	—	—	—

SOURCE: THE OFFICE OF SCIENCE AND TECHNOLOGY, JAPAN ANNUAL REPORT ON FOREIGN TECHNOLOGY INITIATION SHOWA 56 (1981) TABLE 10.

**Table 2**

Atlantic trade, making the Pacific Basin the most important area of concern for the United States.

### THE FLOW OF TECHNOLOGY

Many nations in the world are actively engaged in technology transfer. Table 2 indicates the value of the technology trade of the major market economies between 1965 and 1981. The United States was the world's largest net exporter of technology, followed by France and the United Kingdom. The technology exports of the United States were three times greater than those of France. The world's major net exporters in commodity trade, Japan and the Federal Republic of Germany, both showed a substantial technology trade deficit. However, information on remittances on new contracts suggested that Japan would soon become a net exporter of technology.<sup>2</sup> In fact, a Japanese delegate at a meeting

in New Delhi stated that Japan has indeed become a net exporter of technology in 1985.<sup>3</sup> It is, however, readily apparent that the world of technology transfer is dominated by the United States in terms of absolute amount received and paid.

A comprehensive study of the technology flow in the Pacific region is not easily compiled. Many countries do not maintain records of technology transfer transactions even for the purpose of monitoring foreign exchange flows. Nevertheless, Table 3 provides some impression of the picture in four selected Pacific Basin countries. The four countries' combined annual average for 1979-1981 was about US\$227 million, which contrasts dramatically with Japan's average of US\$1,470 million.

Japan also keeps good records of the technology exports, which are depicted in Table 4. More than half of the Japanese projects involving technology exports were in the Asian region and these accounted for about 39%

### PAYMENTS FOR TRANSFER OF TECHNOLOGY; SELECTED ESCAP MEMBER COUNTRIES, 1972-1981 (US\$ MILLION)

COUNTRY	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	TOTAL	3 YEAR
												AVERAGE
DEVELOPED COUNTRIES												
JAPAN <sup>a</sup>	572	715	718	712	846	1027	1241	1260	1439	1711	10241	1470
DEVELOPING COUNTRIES												
India <sup>b</sup>	7.78	3.43	8.23	3.58	8.18	4.87	11.48	7.12	11.25	12.55	78.47	10.31
Republic of Korea <sup>c</sup>	-----	-----	96.51	-----	-----	58.06	85.07	93.93	107.23	107.10	547.90	102.75
Republic of The Philippines <sup>d</sup>	16.76	23.56	34.01	55.73	60.00	63.08	62.20	63.63	72.91	67.92	519.80	102.75
Thailand <sup>e</sup>	-----	-----	377.81	-----	-----	150.75	185.46	199.79	236.81	245.43	1396.05	227.34

SOURCES: a. SCIENCE AND TECHNOLOGY BUREAU, REPORT ON ANNUAL INTRODUCTION OF FOREIGN TECHNOLOGY, TOKYO, (IN JAPANESE), 1981.

b. FOREIGN INVESTMENT BOARD, GOVERNMENT OF INDIA

c. TECHNOLOGY TRANSFER CENTER, GOVERNMENT OF KOREA

d. CENTRAL BANK OF THE PHILIPPINES

e. BANK OF THAILAND

**Table 3**

### DISTRIBUTION OF JAPAN'S TECHNOLOGY EXPORTS IN 1981

Region	Number of projects	Percent	Value (\$US Million)	Percent
Asia	2,696	(55.3)	309	(38.8)
North America	789	(16.2)	174	(21.9)
South America	218	(4.5)	54	(6.8)
Europe	834	(17.1)	146	(18.3)
Africa	146	(3.0)	44	(5.5)
Oceania	129	(2.6)	24	(3.0)
Destination				
Unidentified	65	(1.3)	45	(5.7)
Total	4,877	(100.0)	796	(100.0)

Source: Report on the Survey of Research and Development, Prime Minister's Office, Government of Japan, 1982, Table 1, page 37.

**Table 4**

of the total monetary income from such technology exports.

The experience of newly-industrialized countries suggests that payments for technology tend to increase as a country industrializes. For instance, between 1962 and 1972 the number of contractual agreements concluded by Korean enterprises increased from 2 to 60 agreements per year. The number of concluded agreements increased at an accelerated pace from 65 in 1974 to 296 contracts in 1978. In value terms, technology payments nearly doubled from US\$58.1 million in 1977 to US\$107 million in 1981. Even in Japan, where the general levels of manufacturing technologies are relatively advanced, payments for imported technologies increased from US\$572 million in 1972 to US\$1,711 million in 1981 (Table 3). It is apparent from the case of Japan that, even when a country has become an exporter of technology, it will also continue to import some technology for a long time.

In East and Southeast Asia, Japan is presently the most prominent technology supplier. Japanese firms were the contracting parties in 32% and 37% of agreements concluded with business firms in Malaysia and Thailand, respectively. The share of Japanese technology suppliers in Korea was as high as 45.6% during the 1962 to 1981 period. However, as will be shown later, the United States also figured as a major source of technology in the case of Korea.

Korean industries have gained very valuable experience in learning how to acquire technology to sustain their economic growth. In the past two decades, Korea has demonstrated its thirst for new technology and its ability to absorb and digest advanced technology with relative efficiency. This trend is continuing and, in fact, is being recognized as one of the key ingredients in sustaining the export drive and strengthening technology-intensive small and medium industries. It is also important to note that each new generation is becoming better educated. Furthermore, Korean industry is rich in eager entrepreneurs who are willing to import technology in a bold way. The government will also induce the nation to stimulate technology innovation by spending more on research and development activities. Industry is also responding well to the government's incentive plans to provide various tax and other benefits to companies who commit funds to the R&D program.

Looking back, Korea's economic growth was realized through the fortunate combination of a diligent and well-

educated work force, dynamic entrepreneurs, and able government leadership. The result was an export-led economy, backed by an efficient labor-intensive industry that could produce competitive products in the world market. However, the economic growth can no longer be sustained unless the quality of Korean industries is upgraded through systematic efforts to absorb higher quality technology, either through independent Korean efforts or by linking up with foreign technology sources. It is, therefore, very timely to review how Korea has acquired technology in the past and what it must do in the future to continue the technological advancement. Korea may be entering an era in which the technologists may hold the key to the future.

This assertion is contrary to the notion that a country can become a significant industrial power simply on the basis of proficiency in production.<sup>4</sup> Shipbuilding and steel-making in Korea are probably good examples of this. There is also tremendous efficacy in relaying on export activity as a means of acquiring technology and industrial competence. Exporting appears to offer the means of acquiring technical information and improving productivity.<sup>5</sup> Technology, national economic growth, and industrial production, therefore, are all related factors in the same equation that has to be solved by a developing nation.

There is no demarcation as to where the requirement for technology aimed at productivity improvement leaves off and the need for more innovation-oriented technology is felt by industry. The fact that Korean industries have begun to establish development laboratories at an unprecedented pace is an indication that the industries now recognize the importance of technology and research. The acquisition of technology is an important question faced by the technologist and management alike.

The most visible sign of industrial development activities can be observed by examining the statistics of technology imports into Korea shown in Table 5. It can be seen that, from 1962-1982 Korea imported 2,281 cases of technology equivalent to US\$680 million.

We can readily see that the United States and Japan supplied the majority of technologies, which Korea needed to develop its industries. The Korean government, in order to stimulate the continuous flow of technology, has instituted a gradual liberalization of the import policy. This move led to the most recent revision of the Foreign Capital Inducement Law in July 1984. Under the new law, foreign investment is generally permitted

### TECHNOLOGY IMPORTS INTO KOREA

(Unit: Cases/US\$1 Million)

Year	USA	Japan	West			Others	Total
			Germany	France			
1962-1971	74/8.4	214/5.0	10/2.6	1/-	19/1.0	318/17.0	
1972-1976	90/21.3	280/58.7	13/5.6	6/1.6	45/9.4	434/96.5	
1977	45/17.2	82/25.4	16/2.6	3/5.0	22/12.4	168/58.1	
1978	67/24.2	157/28.0	12/2.8	9/1.1	51/29.0	296/85.1	
1979	61/34.2	157/22.8	17/3.3	8/4.3	45/29.4	288/93.9	
1980	54/35.5	124/28.2	10/2.8	9/5.7	25/34.9	222/107.2	
1981	74/48.0	109/35.4	15/2.5	11/2.7	38/18.5	247/107.1	
1982	68/59.5	164/29.3	14/2.9	16/3.7	46/20.3	308/115.7	
Total	533/248.3	1,287/232.9	107/25.1	63/19.5	207/154.9	2,281/680.6	
%	23.3/36.4	56.4/34.2	4.7/3.7	2.7/2.9	12.8/22.7	100.0/100.0	

Source: Ministry of Science and Technology

**Table 5**

in any industry except those specifically restricted (the "negative list"). This negative list is not extensive. Under the new law, applications for investment will be automatically approved by the Minister of Finance if the following conditions are met:

1. The industry is not on the negative list.
2. Foreign ownership is less than 50%.
3. The amount of foreign investment does not exceed US\$1,000,000.
4. The company does not request a tax holiday.

A higher percentage ownership is possible and a tax holiday can also be granted through review processes. This liberalization should make the technology acquisition easier through direct investment and joint ventures.

Needless to say, the progress of science and technology is not achieved solely on the basis of technology imports alone. In fact, Korea embarked on an ambitious self-development program by establishing a multidisciplinary research institute called the Korea Institute of Science and Technology (KIST) in 1966. The required endowment fund was provided by the governments of Korea and the United States. The Institute was built to provide a place that engineers and scientists trained overseas could return to and practice applied research in Korea. Soon afterwards, in 1971, the Korea Advanced Institute of Science (KAIS) was founded as a graduate school to supply the well-educated engineers and scientists needed for industrial development. The two Institutes merged in 1980 to become KAIST. Subsequently, many satellite institutes were either spun off or newly formed. The impact of these semi-public research institutes has been significant and the effort to make these institutes more efficient is still continuing.

Beginning around 1980, however, the private sector industries also began to think earnestly about the need for R&D. Consequently, we are currently witnessing vigorous activities by nearly all sectors of industry to establish their own laboratories. The steady promotional legislation and incentive measures established by the Ministry of Science and Technology (MOST) are finally taking effect.

Total investment for technology development in Korea in 1984 was W958 billion (about US\$1.1 billion). This amounted to about 1.46% of Korea's gross national product. Of this amount, 68% was spent by industry. The government-related budget for science and technology in 1985 was W34.56 billion (about US\$406 million). In absolute terms, Japan spends 21 times that sum for technology a year. In the United States the amount spent is 152 times, in the United Kingdom 19 times, and in West Germany 14 times that of Korea. Whether the technology gap between the developed and the developing can be narrowed is, therefore, a difficult question to answer.

I recently took part in the project of measuring the technology level of Korea. The Japanese used a yardstick which consisted of registered patents, the volume of technology trade, the amount of value added by the manufacturing sector, and the export amount of the high-technology products. The outcome for the second half of the 1970s was: the United States 100, West Germany 54.7, and Japan 49.9.<sup>6</sup> A similar study for the R&D capability also shows a wide gap between the United States and other developed nations. Our efforts to

measure Korea's potential resulted in very low numbers. While the yardsticks used may be open to question, such efforts should be conducted periodically to calm the emotional atmosphere that exists in dealing with technology transfer. A well conducted study of this type may convince all nations concerned that a smooth technology flow among the friendly nations can only enhance the economic development of the region, which in turn can contribute to the political stability of the Pacific Basin countries.

#### FOR BETTER UNDERSTANDING

In October 1984, I had the opportunity to attend a meeting to discuss the issue of national policies for technology transfer, sponsored by the Pan-Pacific Community Association. At the meeting, one of the delegates from the United States brought up the issue of "transparency." The vocabulary was used to describe the difficulty Western nations have in understanding Japan. What people want to know is, who is the one who is pushing all the right buttons to make Japan so competitive if, indeed, such a person or organization does exist. Japan, as a cultural and behavioral group must baffle people of the West. Actually, I believe the same thing can be said of the nations of the West. The Japanese must have a terrible time understanding many odd things done in the West.

Even within the East Asian region, one must try hard to understand another's position in light of the cultural differences. Japan, as shown earlier, is most diligent in importing, absorbing, and improving the technologies developed elsewhere. Yet, when Korea wanted to effect technology transfers from Japan, the Japanese business community until recently talked of the "boomerang" effect. The United States, privately and sometimes publicly, rejected the idea of letting Korea and Taiwan become "second Japans."

I hope this paper has presented some data to support the assertion that the gap between the developed nations and the developing has a better chance of widening in the future. Although difficult to prove, I also think the technology flow between the friendly nations will continue since it is a natural occurrence for people who want to better themselves. It is also true, in many cases, that the technology market is a buyer's market, in fact, a very dynamic one. I also would like to venture to state that economically strong Pacific Basin countries will be better able to maintain peace, and that a healthy flow of technology will enhance the process of economic developments in every nation.

#### NOTES

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5. *Ibid.*
6. Ministry of Science and Technology, Japan, *Science and Technology White Paper, 1977.*