TECHNOLOGY TRANSFER MANAGEMENT – SOME POLICY ALTERNATIVES:

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I. INTRODUCTION

A. Scope

This paper covers a brief overview of technology transfer at the global and regional level and the significant findings of a study of international technology transfer into the Philippines from 1978 to 1981.

Significant policy issues and alternatives bearing on international technology transfer are discussed.

B. Place of Technology Transfer in the Overall Development Plan

Technology transfer must play a key role in the overall socio-economic development plan especially of developing countries. This is so because to a large extent the comparative advantage which spells success in this competitive world is realized through better technologies i.e. better products, processes, machineries and technologists and managers. Since the time and costs for developing and generating technologies is usually tremendous, many countries such as Japan and the newly industrialized countries and many developing countries have opted for importation of technology as a less expensive and speedier means of economic development. Technology Development policy forms part of the national S & T Plan which in turn forms part of the overall socio-economic development plan.

II. GLOBAL AND REGIONAL TECHNOLOGY TRANSFER

A. Some Basic Considerations

1. Categories of Transfer Activities

- a. Transfer of commercial assets involving those assets which are not commonly available in the public domain
- b. Transfer of non-commercial assets whose fruits cannot be fully appropriated through pecuniary means consisting largely of science-based and commercially untested technologies.

This paper deals only with the first category.

2. Types of Technology Transfer

- a. Foreign direct investment package including capital, technology and management from a single source.
- b. Contractual Agreements
 - 1) licensing arrangements involving the transfer of the right to use certain property such as patents, trademarks or tradenames
 - 2) Transfer of skills, experiences and knowledge which are already in the public domain, for example, technical assistance, know-how agreements, turn-key contracts, service and engineering agreements.
 - 3) Combination of b 1 & 2 or a & b 1 & 2

3. Forms of Technology Transfer

- a. Capital goods such as machineries and equipment
- b. Services of experts/technicians
- c. blueprints and documents describing products and process

The total cost for technology transfer includes payments for technical assets, technicians, training expenses and machineries

B. Technology Trade of Developed Countries, 1965-1981 (See Table 1)

Table 1 shows that from 1965 to 1981 the U.S. was the world's largest net exporter (Receipts of \$1.5B to \$7.0B) followed by France (Receipts \$0.169B to \$2.0B) then United Kingdom (Receipts \$0.138B to \$0.744B)

C. Payments for Transfer of Technology – Selected ESCAP Member Countries 1972-1981 (See Table 2)

Table 2 shows the extent of technology transfer payments by selected ESCAP member countries. Based on the 3 year average from 1979 to 1981, Japan leads with \$1.47B followed by Republic of Korea with \$0.102B and the Philippines with \$0.068B.

D. Major Sources of Technology for Selected Developing Countries in ESCAP Region. (See Table 3)

Table 3 shows the major sources of technology of selected developing countries from 1978-1979. The top 3 donor countries are:

1. U.S.A. – 876 agreements in 6 countries
2. Japan – 650 agreements in 6 countries
3. Australia – 66 agreements in 6 countries

E. Frequency of Restrictive Business Practices in Selected Asian Countries. (See Table 4)

Table 4 shows the frequency of restrictive business practices in selected Asian countries.

In this analysis, the highest frequency is with export restrictions followed by restriction on the use of know-how upon expiry and applicable laws other than recipients country.

TABLE 1 : Technology trade of developed countries, 1965-1981^a
(\$ US million)

Year	Japan			United States			United Kingdom			Federal Republic Germany			France		
	Re- ceipts (A)	Pay- ments (B)	A/B (%)	Re- ceipts (A)	Pay- ments (B)	A/B (%)	Re- ceipts (A)	Pay- ments (B)	A/B (%)	Re- ceipts (A)	Pay- ments (B)	A/B (%)	Re- ceipts (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	225	107.1	119	306	38.9	344	357	96.4
1971	60	488	12.3	2 545	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	2 033 ^b	1 663 ^b	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:

^a The Office of Science and Technology, *Japan Annual Report on Foreign Technology Initiation*, Showa 56 (1981)

^b Long-term Credit Bank of Japan.

Note: The figures in the table are converted from Yen using the implied rate from the source document.

TABLE 2 : Payments for transfer of technology: selected ESCAP member countries, 1972-1982
\$ US million)

Country	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	Total	3 year Average 1979-1981
<i>Developed countries</i>												
Japan ^a	572	715	718	712	846	1 027	1 241	1 260	1 439	1 711	10 241	1 470
<i>Developing countries</i>												
India ^b	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 ^c			96.51			58.06	85.07	93.93	107.23	107.10	547.90	102.75
Republic of the Philippines ^d of which:	16.76	23.56	34.01	55.73	60.00	63.08	62.20	63.63	72.91	67.92	519.80	68.15
Royalties/ technical fee	5.81	8.83	13.62	16.56	22.01	28.51	28.56	30.74	36.32	37.59	228.55	34.88
Salaries+ fees	10.95	14.73	20.39	39.17	37.99	34.57	33.64	32.89	36.59	30.33	291.25	33.27
Thailand ^e	6.79	9.83	11.12	14.55	17.75	24.74	26.71	35.11	45.42	57.86	249.88	46.13
Developing countries combined			377.81			150.75	185.46	199.79	236.81	245.43	1 396.05	227.34

Sources:

^aScience and Technology Bureau, *Report on Annual Introduction of Foreign Technology*, Tokyo (in Japanese), 1981.

^bForeign Investment Board, Government of India.

^cTechnology Transfer Centre, Government of Korea.

^dCentral Bank of the Philippines

^eBank of Thailand.

TABLE 3 : Major sources of technology for selected developing countries ESCAP region
Number of agreements and percentage

Recipient	Japan ^a 1980-1981	Republic of Korea ^b 1962-1981	Malaysia ^c 1960-1981	Philippines ^d 1978-1979	Thailand ^e 1980-1981	Sri Lanka ^f 1950-1981	India ^g 1978-1982
Source							
Japan	—	190 (45.6)	106 (30.5)	31 (20.6)	141 (36.3)	13 (8.8)	169 (7.0)
United States	977 (47.1)	158 (37.9)	51 (14.7)	69 (46.0)	73 (18.8)	15 (10.2)	510 (21.0)
United Kingdom	175 (8.4)	10 (2.4)	47 (13.5)	10 (6.7)	30 (7.7)	35 (23.8)	475 (19.6)
Australia	12 (0.6)	—	22 (6.3)	4 (2.7)	15 (3.9)	3 (2.0)	10 (0.4)
Other developed countries	884 (42.6)	59 (14.1)	68 (19.5)	30 (20.0)	84 (21.7)	37 (25.2)	198 (49.4)
Developing countries	28 (1.3)	—	54 (15.5) ^d	6 (4.0)	45 (11.6)	41 (28.0)	36 (1.5)
Not stated or others	—	—	—	—	—	3 (2.0)	27 (1.1)
Total	2076 (100.0)	417 (100.0)	348 (100.0)	150 (100.0)	388 (100.0)	147 (100.0)	2 425 (100.0)

Sources:

^aScience and Technology Bureau, *Annual Report on Introduction of Foreign Technology*, Tokyo 1981.

^b"Foreign investment and technology transfer in the Republic of Korea," *Ibid.*, Part Two, Chapter I.

^c"Technology transfer from transnational corporations in Malaysia," *Ibid.*, Part Two, Chapter II.

^dTechnology agreements filed at the Technology Transfer Board between 1978 and 1979.

^e"Technology imported through contractual arrangements: a case study of Thailand," *Ibid.*, Part Two, Chapter IV.

^f"Technology transfer from transnational corporations in Sri Lanka," *Ibid.*, Part Two, Chapter III.

^gForeign collaborations approvals issued during the period 1978 to 1982. Department of Industrial Development Government

TABLE 4 : Frequency of restrictive business practices in selected Asian countries
(per cent distribution in parenthesis)

Type of restrictive clauses	Japan ^a (2,076)*	Korea ^b (200)*	Philippines ^c (151)*	Thailand ^d (388)*	Malaysia ^e (391)*	Sri Lanka ^f (140)*
(a) Exports restrictions such as the following: permission of licensor prior to export; exports permitted only to certain countries; exports prohibited; and exports restricted to licensor's agents/distributors	507 (24.4)	48 (24.0)	31 (20.5)	97 (24.9)	119 (30.4)	39 (27.8)
(b) Tied-in purchase of raw materials/equipment	—	33 (16.5)	19 (12.6)	29 (7.5)	57 (14.6)	31 (22.1)
(c) Royalty-free grant back of licensee's improvements	—	—	26 (17.2)	13 (3.4)	3 (0.8)	—
(d) Patent/process improvement of licensee accruing to licensor	—	9 (4.5)	4 (2.6)	15 (3.9)	6 (1.6)	5 (3.4)
(e) Restriction on the use of know-how upon expiry of contracts	—	—	30 (19.9)	75 (19.3)	44 (11.2)	30 (21.4)
(f) Venue of dispute settlements in supplier's country	—	14 (7.0)	16 (10.6)	87 (22.4)	18 (4.6)	18 (12.9)
(g) Applicable laws other than recipient's country	—	—	—	78 (20.1)	12 (3.1)	31 (22.1)

*Indicates total number of contracts for each country sample.

SOURCES:

- ^aScience and Technology Bureau, *Annual Report on Introduction of Foreign Technology*, 1981, Table 7.
^b"Foreign investments and technology transfer in the Republic of Korea," *Ibid.*, Part Two, Chapter I
^cLilia R. Bautista, op. cit. p. 25.
^d"Technology imported through contractual arrangements: a case study of Thailand," *Ibid.*, Part Two, Chapter IV
^e"Technology transfer from transnational corporations in Malaysia," *Ibid.*, Part Two, Chapter II
^f"Technology transfer from transnational corporations in Sri Lanka," *Ibid.*, Part Two, Chapter III

III. THE PHILIPPINE EXPERIENCE

The screening of imported technology is undertaken by the Technology Transfer Board (TTB) an interagency body under the Ministry of Trade and Industry created in 1978, and composed of the representatives of the following agencies:

- Ministry of Trade and Industry
- Board of Investments
- Central Bank of the Philippines
- Philippine Patent Office
- National Economic Development Authority
- National Science and Technology Authority, and
- Technology Resource Centre

The policy guidelines and rules and regulations have been discussed earlier this morning.

Since 1978 up to June 30, 1981, the TTB has approved 324 contracts. These agreements have been analyzed in various ways, and the findings are presented below. For brevity, the top 3 and their corresponding percentages in each are the only ones mentioned here.

Nationality of Technology Sources		Percentage of Total
1. U.S.A.		42%
2. Japan		22%
3. Switzerland		7%
Industrial Sectors		
1. Electrical Supplies, appliances & accessories		15%
2. Metals and Metal Products		12%
3. Textile, Wearing Apparel and Accessories		10%
Types of Technology Transfer		
1. Knowhow and Trademark Combination		32%
2. Knowhow alone		30%
3. Patent, trademark and knowhow combination		24%
New or Renewal		
1. New		60%
2. Renewal		40%
Royalty Rates		
1. Two Percent Royalty		20%
2. Three Percent Royalty		17%
3. One Percent Royalty		14%

Form of Payment

1. Running Royalty	67%
2. Fixed Royalty	13%
3. (Lump Sum	8%
(	
(Lump Sum plus running royalty	8%

Restrictive Clauses

1. Interpretation of agreement in accordance with laws other than Philippines	36%
2. Export Restrictions	22%
3. Post-Termination Restriction	17%

Total with restriction	88%
Total without restriction	12%

Benefits to the Economy

The total agreements from 1978 to June 1981, represents a total foreign exchange savings of \$94M or \$133,000 per year.

Total estimated foreign exchange earnings for 5 years from projected exports is \$1.2B or an annual earnings of \$2.2M for each of the 104 exporting firms.

The average annual level of employment by these companies established through technology transfer arrangements is 10,800.

Local R & D and Linkages with Public Sector Research Institutes

To varying degrees, recipient companies conduct some R & D generally related to the use of local materials, adaptation to local conditions, and improvement or development of new products.

Linkage with government laboratories and research institutes is mainly for testing and analysis. Occasionally, recipients firms may engage the research institutes for contract research, but their major R & D needs are met by the technology donors abroad.

IV. POLICY ISSUES AND ALTERNATIVES

There are generally three areas for policy decisions with regards to technology transfer.

1. Choice between free and controlled imports of technology

A free or non-interventionist policy usually means for developing countries:

- a. excessive financial cost
- b. restrictive business practices
- c. transfer pricing
- d. added burden to balance of payments
- e. negative effect on local technological development

On the other hand, a free flow policy enhances and accelerates technological development.

The Philippines with the creation of the Technology Transfer Board in 1978 has opted for controlled imports but has been quite liberal in the implementation of its policy guidelines so that technologies/trademarks have been imported even if they do not involve new product or process utilizing indigenous raw materials.

The Philippines could opt for a policy of strict implementation of the guidelines for selective importation of technology with close monitoring to ensure compliance.

2. Alternative Channels of Technology Transfer

The two extremes are: the packaged foreign direct investment in a wholly or majority-owned subsidiary preferred by Transnational Corporations (TNC) or the unpackaged non-equity arrangements involving contracts for payments of constituent elements of the package such as technology, technicians, training expenses, or machineries, or combinations of these elements.

The policy consideration include whether the packaged or the unpackaged mode offer advantages by way of financial cost to the recipient firm, impact on the host country's economy and achieving the host country's development objectives.

Although packaged foreign direct investment leads to an apparently less expensive initial acquisition of technology, the close and often secret relationship between TNC's and subsidiaries is more susceptible to transfer pricing through overpricing and underpricing transactions involving raw materials, intermediate goods, machineries, loans, technology and management. Moreover when concealed payments and implicit costs are taken into account, the cost of technology acquired through foreign direct investment may be very high.

The Philippines have encouraged packaged foreign direct investment, as well as, lately unpackaged non-equity technology transfer arrangements. It might be well to decide on a case to case basis and examine alternative arrangements depending on such variables as stage of development, absorptive capacity of the host country and recipient firms and general economic setting, in order to maximize economic as well as social benefits.

3. Economic Policies in Effective Technology Transfer

Effective and appropriate transfer of technologies requires coordination of technology policy with the national socio-economic development policy. This is so because the demand for technology is a derived demand i.e., it is required for the production of the mix of goods and services determined by the countries political and socio-economic structure and prevailing economic and industrial strategies

As an illustration, Tariff policy has a minor influence on the industrial pattern and therefore technology transfer pattern, as well. A high tariff on motor vehicles for instance, would promote assembly type industries. A protectionist policy on final consumer products in general, would result in importation of technologies for simple production technics only, like assembly, mixing operations and packaging. This seems to be true in the Philippines for the automotive and pharmaceutical industries. For the automotive industry, if effective backward technological linkages are desired, the policy should be to emphasize fast moving items such as spare parts requiring frequent replacement, therefore having larger markets which allows for economic of scale and long term economic viability. If

the industrial guideline emphasizes local content based on the value of each locally-produced component instead, the incentive is for the assemblers to choose components with high value which is likely to have a high import content, resulting in restricted production and high cost of the spare parts.

Investment in Local R & D vs. Import of Technology

Govindarajulu (1983) has proposed a ratio E of annual investment in indigenous R & D effort (x) to import of technology (y) as an index of technological assimilation, as given in the equation

$$E = \frac{x}{y}$$

From an analysis of data among countries in different stages of industrial development a threshold value of 4 for E is a characteristic of industrialized countries.

For the Philippines, the value of E during the period 1974 to 1980 is between 1 and 2 meaning we are still way below the threshold value indicative of intensive industrialization.

To reach the threshold value of $E = 4$, there is a need to increase both government and private sector investment in R & D to achieve the level recommended by UNESCO for developing countries of 1% of GNP and over the longer term a steady state level of 2% of GNP.

For government this means a greater share of the government budget devoted to S & T towards a level of 2% in the near future and 4% of total appropriation in the longer term from the present level of about 0.5% of government appropriation.

To encourage the private sector to invest in R & D in preferred areas, incentives may be provided in the form of tax or duty exemption or credit on imported capital equipment, net operating loss carry over and deduction of R & D expenses over and above the usual allowed for business expenses.

In concluding, technology transfer policy is but a part of science and technology policy which in turn is a part of the overall socio-economic development policy. In order to have efficient and appropriate transfer of technologies, the right S & T policies and agro-industrial development strategies, taking full advantage of the country's existing natural resources and human resource endowments, must at the same time be pursued.

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