Inducing Foreign Technology

How Korea achieved high rates of economic growth; a review of policies and institutional arrangements; a potential role for fast-developing nations.

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The transfer of goods and services across national boundaries is an age-old practice, but what is new perhaps is the addition of the transfer of technology to the major agenda at important international economic and political forums, particularly when so-called North-South problems are at issue.

Many consider the issues associated with technology transfer, as perhaps the most fundamental elements acting as catalysts in what James Howe (1975) called "the changing chemistry" between North and South. For this reason, it has been the object of inquiries and treatises by many in both the public and private sectors, and by developed and developing countries.

It is a subject, which, by its very nature, lends itself to a multiplicity of ideas and opinions, often diametrically opposing each other depending on first, which side of the transfer one looks at, and second, what the transfer's aims are.

The case of Korea is of particular interest. Its economic achievements since the launching of the First Five-Year Economic Development Plan in 1962 have been extraordinary; the GNP grew at about 10% per annum in real terms, about 18% growth in manufacturing sector, about 27% growth in total exports of which the share of the manufactured goods rose to about 90% in 1978 from only 14% in 1960, and creation of rapid employment opportunities as many as some 2 million new jobs during Third Five-Year Plan period (1972-1976).

Transformation

Such sustained high rates of economic growth stemming from the system of free enterprises operating at near free-trade regime have virtually transformed the country from, according to the World Bank, one of the poorest countries with a stagnant and heavily agrarian countries in the world to a semi-industrialized, middle-income country. Such a structural change does not occur in vacuum, but rather technology in its broadest sense assumes a critical importance.

The purpose of this paper is to review some aspects of the policy instruments and institutional arrangements which have been evolved in Korea over the last decade with particular reference to inducement of foreign technology. First, this paper deals with the overviews of policy instruments for promoting technology transfer in general. Second, after giving an overview, this paper concentrates on an analysis of the licensing agreements under which the bulk of foreign technologies have been brought into Korea.

LES Australia International Meeting

In discussing development and inducement of technology in developing countries, it would be useful to divide the subject into three stages: 1) implementation of imported technology, 2) assimilation of foreign technology, and 3) improvement of foreign technology. This is a simple classification but it may have some relevance in generalizing about the current stage of development. Most semi-industrialized countries have already gone through the first stage and are in the second with some few having entered into the third.

The technology policies of the developing country should reflect the stage in which it finds itself. In the case of the implementation stage, indigenous technological capability is inversely correlated with import and export policy, government incentives for technological change, raw material suppliers and technology suppliers. In other words, government policy is a major influence in this stage in two ways: 1) the transfer of foreign technologies occurs as a result of government import substitution and market protection policies, and 2) various government incentive programs are perceived as important stimuli for technological change by industry.

In the case of the assimilation stage, import substitution policy alone may make it difficult to establish a viable industry, as the chief stimulus for new product design and development stems less from domestic consumers than from custom orders from overseas distributors and original equipment manufacturers, particularly in the electronics sector. Also, this is the stage in which competition enters into the picture not only from inside but also from outside the country which then compels the assimilation of new ideas.

Many of the developing countries' electronic products for domestic and overseas markets, as for instance black and white and color TV and in some cases audio equipment, calculators and watches, belong in this category. It is also the stage in which the need for technology capability in the local R&D institute is very great as industry itself is short of R&D facilities for assisting the assimilation process.

Local R&D institutes at this stage, however have extreme difficulty in maintaining a viable capability for assisting industry unless a host of deliberate and concentrated efforts are made in so innovative a way that

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they somehow are staffed with high-caliber personnel, both flexible and dynamic, and with autonomy and independence from the government system. Unless the local R&D institution is made viable at this stage, the opportunity cost will be extremely high.

This is the stage in which so-called "unpackaging" or "unbundling" of internationally transferred, packaged technologies can and should be achieved, principally with the aid of the local R&D institution. Thus, this is the stage in which government intervention could become important enough so that the proper mix of appropriate instruments would make it possible to get both industry and R&D institutes on the right track leading to the much hoped for improvement stage.

Korea opted for creating a new multidisciplinary industrial research institute outside of the government structure. From the inception of the institute, the Korea Institute of Science and Technology (KIST) was given the autonomy of its operation despite heavy government financing. The contract research format was adopted both to encourage effective involvement by the sponsoring industrial enterprises and to assure responsible performance of researchers. Since 1966 the institute has built up the facilities and the expertise to undertake the broad range of research or technological services demanded by Korean industries in the fields of electronics, materials, machinery, and chemicals as well as technoeconomic studies, involving inducement of high technology and foreign capital.

H. S. Choi (1975) writes, in reflection of his association with KIST as its first president, as follows:

> "KIST in my belief, has fulfilled original expectations, particularly by its spillover effects. In tangible contributions to development and adaptation of industrial technologies, KIST's success cases are numerous in consideration of its short history, but many more of them are required for a significant impact upon Korean industry as a whole. As had been hoped for by those who took part in the inception of the Institute, the concept of a multidisciplinary R&D institution, chartered and operated in the way KIST is, enjoying support by the legislature and by the President of the nation, proved to be a viable proposition."

The expansion of the Korean economy and the increasing sophistication and diversity of its industry, especially in pursuing strategic industries, called for additional capability in R&D and in performing specialized studies over a wide range of subject areas. The approach taken by the Korean government was to establish specialized research institutes in each strategic sector, either spinning off from KIST in such areas as shipbuilding, electronics, and telecommunication, or establishing new institutes.

Improvement Stage

As to the improvement stage and partly in the case of the assimilation stage, a most important source of stimulus for the generation of new technologies is considered to be competition. Tilton (1971) in his study on the international diffusion of technology with particular reference to semi-conductors also singled out competition as one of the most important instruments the government of Japan used in advancing its semiconductor industry in competition with the U.S. where virtually all of the technology originated in the first place not to mention European countries so far as consumer and industrial semiconductors were concerned.

What is at stake at this stage is that the developing country not just glean what is sophisticated and fancy but acquire capacities to work toward sophisticated technologies. This is, therefore, a stage in which the organization of talents assumes critical importance. To generalize, emphasis should be placed on engineering in the implementation stage, on engineering and development in the assimilation stage, and on engineering, development and research in the improvement stage which is literally a reverse approach, and this is essential.

In order words, if one were to try to stress R, D, & E collectively from the first it would be easy to run the risk of dissipating, if not wasting, local talents and resources among too many fundamental problems which can only be coped with adequately over long periods with inputs often beyond the reach of a developing country for some time to come. A study commissioned by the U.S. National Academy of Sciences (1973) concluded that "as a matter of fact, the experiences of many successful developing countries at the individual-enterprise level suggest that the R, D, & E sequence is usually reversed: acquisition of capabilities proceeds from E to D to R."

Vicious Cycle

Lack of technological capability to adapt and improve foreign technology invites a vicious cycle of technological dependency. A licensee usually prepares another license agreement to extend an existing agreement before the existing agreement expires.

Sometimes purchased technology becomes obsolete because of improved technology. Such arrangements obviously cost developing countries too much and perpetuate technological dependency which further invites "expropriation" effects on the developing country economy as "dependency theories" contend.

The best way for developing countries to achieve their national development seems, therefore, to make the best of the complementary aspect of two technological activities, R&D and introduction of foreign technology. The Japanese experiences, in general, substantiate this argument by taking note of the fact that the royalty payment for foreign technology in total represents less than 10% of the total R&D in the country. This is in sharp contrast to the situation in Korea, where both are almost at par in terms of money involved.

In recognition of the pressing needs for local adaptation and improvement, where possible, of induced foreign technology, the Korean government enacted several laws for technological development. The Law for The Promotion of Technology Development was promulgated in 1972 to provide, among others, financial and fiscal incentives to private industries, particularly for adaptation and improvement of foreign technologies.

ARRANGEMENTS FOR INDUCING FOREIGN TECHNOLOGY

The laws and regulations governing the inflow of foreign technology and engineering services into Korea have been quite promotional in character and they have been increasingly liberalized.

In Korea the licensing agreement is regulated and

Year	62-66	67	68	69	70	71	72	73	74	75	76	77	78 (Estimate)	Total
Case	30	35	50	60	84	45	50	69	86	98	130	170	300	1,207
Royalty Payment (U$1,000)	773	987	1,470	2,530	5,122	6,148	10,263	11,490	17,791	26,541	30,423	58,056	118,000	289,564

License Agreements and Royalty Payments (1962-1978)

Source: Economic Planning Board

Table 1

administered under the Foreign Capital Inducement Law (hereinafter referred to as the law) which was enacted in 1966. The law defines a licensing agreement (an agreement to introduce foreign technology) as an agreement concluded between a Korean national and a foreigner with a view to introducing technology or using it appropriately including industrial property or other technology which the Minister of the Economic Planning Board approves.

The Presidential Decree (hereinafter referred to as the decree) further defines such agreements as those for which technology transfer fees are paid in foreign exchange and the payment period of the agreement is over one year, and the technology to be introduced is not technical service only. Such a licensing agreement is referred to as "first category" and the other agreements not covered by the Foreign Inducement Law as "second category." They are regulated under such laws as the Engineering Service Promotion Law, which the Ministry of Science and Technology administers and the Foreign Exchange Control Law which the Ministry of Finance administers through the Bank of Korea. These classifications are merely for convenience; this paper is concerned with the "first class."

Over the last decade, license agreements have been on a steady increase, reflecting Korean industry's ever increasing demand for advanced foreign technologies. Table 1 shows that both the number of cases and the royalty payments increased from 1973 and the average cost of technology transfer under license agreements has risen rapidly.

Licensors are predominately Japanese, 51% of total royalty payments, and the U.S. and other countries account for 27.3% and 20.8%, respectively (see Table 2). Government policy emphasizes the diversification of licensing partnerships, not only to avoid excessive dependence on any one country but also to introduce advanced and more original technologies from various western countries.

Table 3 shows technology transfer trends with emphasis on technology-intensive heavy and chemical industries. The combination of petroleum and chemical production, electronic and electrical equipment, and the machinery industries accounts for 65.6% and 50.5% of the total cases of agreement and royalty payments, respectively.

The recent license agreement trend indicates that technology transfer is becoming increasingly costly with royalty payments soaring to 5% and more of net sales. This reflects the structural change in Korean industries, which are shifting toward technology-intensive industries, demanding high-cost advanced technology.

The Presidential Decree of the Foreign Capital Inducement Law stipulates that in approving the license agreement each item listed below should be examined:

a. The need for the technology to be introduced.

b. The nature of the technology and the means of technology transfer.

c. The price of the technology and the duration of the agreement.

d. The potential obstacles to indigenous technological development.

e. The relationship with another similar technology.

f. Economic and technical linkage effects.

Contrary to practices in other developing countries, the law specified neither the limit (maximum or minimum) of royalty payments nor regulate over-pricing. In this sense price regulation is flexible enough to induce high-priced technology. Recently, with the improvement of the Korean balance of payments situation, the government's administrative practices have become more flexible. In view of the so-called Arrow's

(Unit in U$1,000)

Year / Country	1962-69	1970	1971	1972	1973	1974	1975	1976	1977	Total	% Share in Total
Japan	1,350.8	1,096.8	2,594.0	5,411.1	5,754.7	9,985.7	16,651.7	20,850.3	25,436.9	89,132.0	51.9 %
U.S.A.	2,776.5	2,464.7	3,128.1	3,193.2	3,642.5	4,178.8	3,991.5	6,259.5	17,221.6	46,856.4	23.7 %
Others	1,637.6	1,560.4	426.1	1,658.4	2,092.7	3,626.5	5,897.3	3,313.6	15,397.5	35,610.1	20.8 %
Total	5,764.6	5,121.9	6,148.2	10,262.7	11,489.9	17,791.0	26,540.5	30,423.4	58,056.0	171,598.5	100.0 %

Royalty Payments to Selected Countries

Source: Economic Planning Board

Table 2

Field	Cases	Royalty($1,000)
Primary Industry	9	2,446.8
Agriculture & Livestock	9	2,446.8
Secondary Industry	842	155,463.4
Foods	12	2,690.6
Pulp & Paper	10	810.9
Textiles	19	965.5
Chemical Fibers	20	12,824.5
Ceramics & Cement	18	1,659.2
Petroleum & Chemical Production	166	54,437.9
Pharmaceuticals	27	1,445.4
Iron & Non-ferrous Metal	81	30,344.7
Electronic & Elec. Equip	175	19,829.8
Machinery	255	22,709.3
Shipbuilding	16	6,093.1
Others	43	1,625.5
Tertiary Industry	56	13,715.3
Electricity	17	6,173.4
Communication	30	5,551.8
Construction	9	1,990.1
Total	907	171,598.5

License Agreements by Industrial Sector (1962-1977)

Source: Economic Planning Board

Table 3

dilema, strict regulation of the price of technology might be an obstacle to the effective inducement of advanced technology. The way to improve the bargaining position is to have the licensee equipped with better information about the technology to be introduced, which means strengthening technological capabilities.

Administration

Since the license agreements are regulated under the Foreign Capital Inducement Law, the Economic Planning Board, as the overall coordinating and planning agency for Korean economic development as well as the administration of foreign capital assumes prime responsibility for the administration of licensing agreements. According to the law, a license agreement must be approved by the Minister of the Economic Planning Board which can attach conditions to it if necessary.

Before the revision of the law in April 1978, the Economic Planning Board had to refer to concerned ministries for their review of every license agreement submitted for approval.

The approval procedures were so complicated and time consuming that the effective administration of the introduction of quality technology was jeopardized. In addition to administrative difficulties, the following factors also affected the revision of the law which moved one step toward the liberalization of the license agreement control.

a. Balance of payments problems were largely solved due to phenomenal economic growth and export promotion.

b. As the industrial structure was modernized, the demand for advanced technologies increased.

Under the Revised Presidential Decree of the law, the following three different approval procedures are introduced to expedite the approval procedures.

a. *Automatic approval:* The Minister of the Economic Planning Board can approve immediately a license agreement which introduces technology related to the machinery, shipbuilding, electronic, electric, metal, chemical, and textile, industries with a royalty payment duration lasting for three years or less, and which satisfies any of the following: 1) US$30,000 or less for initial payment and 3% or less of net sales as the running royalty payment; 2) US$100,000 or less as the lump-sum payment. Exceptions can be made when and if the agreement contains significant unfair and restrictive clauses or intends to introduce the technology which the Minister of Science and Technology has determined is one which has been already developed locally.

b. *Semiautomatic approval:* In approving a license agreement other than the above, the Minister of Economic Planning Board refers the agreement to the concerned ministries for review and they report to the Minister of the Economic Planning Board within 20 days. In the absence of any intervention by concerned ministries within 20 days, the Minister of the Economic Planning Board can approve the license agreement immediately.

c. *Case-by-case approval:* Any of the following agreements are, however, subject to case-by-case approval after review by concerned ministries.

1) An agreement whose duration or payment is 10 years or more, or whose initial payment is US$1,000,000 or more.

2) An agreement which introduces technology in fields of atomic energy, computers, and defense.

After acquiring some positive experiences with such cautious liberalization procedures, the Korean government is on the verge of making further liberalization in the direction of allowing much more discretion on the part of private entrepreneurs. This is a move unique among developing countries and the outcome of this move has yet to be seen.

CONCLUDING REMARKS

To the development planners and enterpreneurs in Korea, it was plain that we had to turn to foreign sources of technology to fill the technological gaps in the course of pursuing rapid industrialization and to spur the development of built-in capability to cope with rapidly emerging technological requirements.

The issue of inducing foreign technology, therefore, has been treated as an integral part of the overall strategy for technological innovation, along with an increase in R, D, & E effort, and the upgrading of technological and managerial manpower, which, after all, is the most important agent for innovation.

For developing countries, the momentum for development is often the prime factor to be considered, in which case microscopic scrutiny of the technology transaction (not the kinds of technology) terms should carry less importance than thorough macroscopic examination of what the transfer will do for the economy as a whole. What is needed is an effort to embrace and use the technologies from advanced countries to the maximum.

There are always two sides and it is essential to strike a balance between the rationality of the means and the urgency of ends. It is a process dynamic in nature, which can best be accomplished where there exist appropriate operative institutional and human settings.

Commitment

To create such an environment with an adequate human factor endowment requires a first-order priority commitment on the part of the country concerned. Some of the approaches taken by Korea have had many positive impacts on the pace and path of economic development, which have been characterized as an atypically rapid industrialization among developing countries.

In an international context, the role of fast-growing developing countries like Korea deserves some attention, for several reasons. The first is their capacity to benefit from the absorption, digestion and adaptation of foreign technology in addition to embarking on their own technological development, albeit modest in scale, and the second is their latent potential as carriers of digested foreign technologies for other less-developed countries, a potential which intrinsically is perhaps better in their case than in the advanced countries by reason of similarity if not relevance. Third, and perhaps not least important, is their growing capacity to respond to changes in international economic environment.

For these reasons, fast-developing countries may play an important intermediary role in the transfer of technology, be it from developed to developing countries, among developing countries, or from developing to advanced countries. Such a role, in turn, could contribute to the establishment of a more viable international economic cooperation system.

Bearing these thoughts in mind and in recognition of the mounting needs for technology in our rather ambitious socio-economic tasks, Korea has been constantly searching for more liberal and equitable procedures for international transfer of technology.

NOTES

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