Changing Dimension of Seller-Buyer Gap

A discussion of the forms and terms of transfers of technology between countries of different economic and social circumstances

BY PROF. F. R. BRADBURY*

I was asked to describe the changing dimensions of the seller-buyer gap in technology transfer and tell how these affect the process of the movement of technology. My credentials for this task include the recent experience of talking to executives and managers of seven multinational corporations covering a range of technologies from medicinals to earth-moving equipment as part of a BIAC-sponsored project. I am not yet free to reveal details of these cases, but they will shape and color my comments here.

F. Bradbury

In addressing this problem one must first of all note the four broad categories of technology transfer: the export of goods, the wholly-owned affiliate, the partly-owned affiliate, and independent licensing. There is also, of course, the further category of those whose business is technology transfer, contract organizations, design and construction purveyors; also must be included are the agencies, national and international, which seek to promote the transfer process — the various agencies of the United Nations, WHO, FAO etc.

We can get an estimate of the dimensions of the flows involved from Table 1 which shows the size of receipts of U.S. companies from royalties and other services compared with their income from foreign investment.

Table 2 shows how much U.S. direct investment there was over the period 1950 - 1973 and how this was distributed among the categories of petroleum, manufacturing, and other ventures.

From LES International Conference, Paris

A picture of the split of U.S. and U.K. investment in affiliates in D.Cs and L.D.Cs is shown in Table 3.

To give an impression of the growth of the direct foreign investment, Table 4 is reproduced from Harry G. Johnson's recent book[1] to show how the volume of such investment has grown from West Germany, U.K. and U.S. over the period 1960 to 1971.

The figures show that direct investment has grown very markedly over the 12-year period, and that the form of affiliate is predominantly wholly owned, and that affiliates in developing countries greatly outnumber those in less developed countries.

Further information on ownership patterns comes from the study by Reuber and associates[2] who recorded information relating to 78 projects with the pattern shown in Table 5. The American preference for 100%-owned affiliates is clearly shown.

I show also two tables (6 and 7) presented at an OECD conference in Paris in 1975 by Carlos de Faro Passos[3] showing how foreign direct investment is more profitable than domestic private investment or public investment in Brazil (ascribed by Passos in part to its greater efficiency) and also how, under political direction, the proportion of investment held by foreign companies gives way to domestic public enterprises.

U.S. RECEIPTS ASSOCIATED WITH INTERNATIONAL TECHNOLOGY TRANSFER
(millions of dollars)

	Annual Averages				
	1966-70	1971	1972	1973	1974*
Fees, Royalties and Other Services					
from Affiliated Foreigners	1,285	1,865	2,090	2,514	2,734
of which License & Rent		941	1,124	1,503	n.a.
Management etc.		923	952	1,012	n.a.
from Unaffiliated Foreigners	458	621	670	740	786
Income from Foreign Investment #	4,547	6,385	6,925	9,415	17,716

#Dividends, Interest and Branch Profits
*Estimated annual rate
Source: Compiled by Robert G. Hawkins, 1975 from U.S. Department of Commerce data (5).

TABLE 1

**Head of Department of Industrial Science, Stirling University, Scotland.*

FOREIGN DIRECT INVESTMENT BY UNITED STATES INDUSTRIES

	1950	1955	1960	1965	1970	1972	1973	
Total book value at year end.	11.8	19.4	31.9	49.5	78.2	94.3	107.3	($B)
Distribution (%)								
Petroleum				31	28	28	28	%
Manufacturing				39	41	42	43	
Other				30	31	30	30	

Source: Compiled by Robert G. Hawkins, 1975 from U.S. Department of Commerce data (5).

TABLE 2

OWNERSHIP PATTERNS OF MULTINATIONAL ENTERPRISES BASED IN SELECTED MAJOR COUNTRIES

Form of ownership	U.S.		U.K.	
	Affiliates in D.Cs	Affiliates in L.D.Cs	Affiliates in D.Cs	Affiliates in L.D.Cs
Wholly (>95%) owned				
No.	3,570	1,573	1,875	1,274
Percentage	67	61	60	63
Majority (50-95%) owned				
No.	936	521	493	260
Percentage	18	20	16	13
Minority (<50%) owned				
No.	373	287	761	499
Percentage	7	11	24	25

Source: Multinational Corporations and World Development (New York: United Nations, 1973) via Harry G. Johnson "Multinational Enterprises", Macmillan, London, 1975

TABLE 3

My final table is reproduced, from a paper given by John Millar of the British LES to the Stirling Symposium on technology transfer in 1974[4]. This is reproduced as Table 8 and it compares income and royalties from European investments in the U.S.A. This is an example of the reverse flow of technology against the predominant direction and it reveals strikingly how income from investments has greatly overshadowed royalty income in every case.

If we may take the income figures in the various tables as indicators of the volume of technology transfer, then it is evident that there is a very great deal of this in progress, particularly between the parent and affiliates situated in developed countries, and that this form of transfer from parent to affiliate is one which is growing in the less-developed countries.

There are great difficulties in the way of using either royalties and fees or income from foreign investment as indicators of the volume and flow-rate of technology movement. The paper by Robert Hawkins[5], from which my tables 1 and 2 are drawn, should be read for a thorough analysis of this problem of measurement. All we may say here is that the dimensions of U.S. direct foreign investment, of which in 1973 43% was in manufacturing, and the large and growing flow of income from foreign investments may be taken as proxy indicators of substantial and increasing technology transfer via the foreign affiliate.

My discussions with seven multinational enterprises and my reading of the numerous papers which have appeared on the subject in recent years convince me that the transfer through the medium of a wholly-owned affiliate is the preferred method of technology transfer by multinational companies. The reasons why this is the preferred method are easy to see and I will discuss these later. It must be added, however, that political and regulative barriers are attempting to reverse this trend. Multinational companies have been involved in licensing, turn-key, technical cooperation, and various other arrangements with centrally-controlled-economy countries that do not permit direct investments and, moreover, there is competition among multinational companies to secure contracts of this nature. So, it is possible to see a new dimension in technology transfer, one that is imposed by political barriers on the preferred method of development. It may be convincingly argued, therefore, that if the less-developed countries raise sufficiently impenetrable barriers to the establishment of affiliates of multinational companies, then they may be able to get the technology they wish by other methods. I shall argue, however, that

STOCK OF FOREIGN DIRECT INVESTMENT OF SELECTED MAJOR COUNTRIES, 1960-71

Year	Book Value (millions of dollars) West Germany	United Kingdom	United States
1960	758.1	11,988.2	32,765
1961	968.7	12,912.1	34,664
1962	1,239.6	13,649.1	37,149
1963	1,527.3	14,646.2	40,686
1964	1,811.7	16,415.6	44,386
1965	2,076.1	16,796.5	49,328
1966	2,513.2	17,531.4	54,711
1967	3,015.0	17,521.1	59,486
1968	3,587.0	18,478.8	64,983
1969	4,774.5	20,043.2	71,016
1970	5,774.5	21,390.5	78,090
1971	7,276.9	24,019.0	86,001
	Average annual rate of growth (percentage)		
1960/65	22.3	7.0	8.5
1965/71	23.2	6.1	9.7
1960/71	22.8	6.5	9.2

Source: Multinational Corporations in World Development (New York): United Nations, 1973)
via Harry G. Johnson "Multinational Enterprises" Macmillan, London, 1975

TABLE 4

OWNERSHIP STRUCTURE OF A SAMPLE OF 78 PROJECTS

Home country of investor	100% foreign owned	Majority foreign owned	50:50	Minority foreign owned	Total
Europe	7	17	0	9	33
N. America	15	7	1	3	26
Japan	3	8	4	4	19

Source: G. L. Reuber *et al* "Private Foreign Investment in Development" Clarendon Press, Oxford, 1973

TABLE 5

RENTABILITE DES 100 PLUS GRANDES ENTREPRISES
BRESILIENNES (%)

	1968	1969	1970	1971	1972	1973	1974	Moyenne
Publiques	6.7	7.7	7.6	9.3	10.1	10.0	11.28	8.96
Privées Nationales	8.0	5.5	10.4	14.1	15.5	15.8	18.40	12.53
Privées Etrangères	8.1	9.7	14.8	18.3	19.4	20.1	20.41	15.83

TABLE 6

DISTRIBUTION (%) DU PATRIMONIE LIQUIDE
SELON LA PROVENANCE

Publiques	58.6	60.2	67.6	69.4	70.9	73.3	74.4
Privées Nationales	13.1	12.5	11.4	11.4	10.6	8.9	10.9
Privées Etrangères	28.3	27.3	21.0	19.2	18.5	17.8	14.7

Source: Revue VISAO "Qui est Qui dans l'Economie Brésilienne" São Paulo, Août 1975, p. 23
via Carlos de Faro PASSOS OECD Conf. PARIS Nov. 1975

TABLE 7

(NET) INCOME AND ROYALTIES FROM EUROPEAN INVESTMENTS IN USA #

Country of origin	UK		EEC		Benelux (millions of dollars)		France		West Germany		Netherlands	
Year	Royalty	Income	Royalty	Income	Royalty	Income	Royalty	Income	Royalty	Income	Royalty	Income
1966	12	125	-1	85	x	2	x	3	x	7	-1	73
1967	11	124	-3	117	-1	9	-1	12	x	14	-1	80
1968	21	149	x	111	x	5	x	11	x	7	x	87
1969	26	159	2	132	1	6	x	12	x	10	1	101
1970	19	164	3	132	1	9	1	9	x	13	1	96
1971	11	236	3	134	1	3	1	10	x	19	1	97

x = vanishingly small
# Source: J. S. Millar, Stirling Symposium, 1974.

TABLE 8

this implies such a gross distortion of the optimal method of technology flow as to constitute a very serious impediment to the gaining of the expected fruits of technological development by the receiving country.

U.N. Is Forum

I do not have to remind you that the United Nations is the forum for the scene of mounting pressures against the transfer via wholly-owned affiliates. LDCs collectively argue (for example, in the "group of eminent persons") that the wholly-owned-affiliate method of transfer results in transferred technology inappropriate to the needs of LDCs and at too high a cost. Nonetheless, technology transfer, even through an affiliate, is preferred to import of products. So we see the spectrum of possibilities from the transfer by the wholly-owned affiliates, which in a narrowly technical sense is the most effective means, through partly owned, to licensing or turn-key packages. Beyond this is the complete ban on the movement of the know-how and its substitution by the import of goods. Where, in this spectrum, the equilibrium point if any, rests depends on the relative strengths of international technology and the politics of the nation state.

This is the heart of the current (and continuing) debate in world politics concerning technology transfer. In essence the crunch lies in international technology being at odds with national politics.

In an article entitled "The Changing Role of the National State"[6] Lindbeck traces the consolidation of the national state through the 18th, 19th and 20th Centuries. Describing the contemporary scene, he writes:

> A celebrated aspect of the technical, economic, and cultural development during the present century, and perhaps in particular during the post-World War II period, is that a great number of human activities have expanded more drastically than earlier across the borders of the national states: research, education, technology, sports, fashion, art, ideology, knowledge, and culture in general. This internationalization process is, perhaps, particularly strong for the economic system, which during the post-World War II period has become increasingly international character in the sense that the international mobility of commodities, factors of production, entrepreneurship, technology and financial capital has increased enormously.
>
> In other words, the economic system tends to be more and more international in character, at the same time as the political system has largely continued to be national. Thus, whereas the consolidation of the national state in the 18th and 19th Centuries was a logical adjustment of the political system to the geographic expansions of the economic system, the national state today tends to run into trouble just because the economic system, in contrast to the political system, goes on expanding geographically over the borders of existing national states. Many national and international problems of today can in fact fruitfully be seen in the perspective of the tensions between a more and more internationalized economic system and still mainly nationally-based political systems. What we are experiencing is an increased difficulty in fitting the new international economic forces — brought about by modern technology and modern economic growth — into traditional political concepts and institutions, based on the notion of sovereign national states.
>
> The internationalization process is particularly apparent in the market system; in markets for commodities, factors of production, entrepreneurship, technology and financial capital. For instance, export and import play an increasingly important role in nearly every sector of the national economy, and individual consumers and firms can to an increasing extent choose between commodities from the whole world, implying that individual firms are confronted with competitors from more and more nations. The markets are increasingly becoming world markets rather than national markets.
>
> We can also notice a considerable internationalization of a number of import institutions, perhaps in particular 'market-oriented' institutions, such as production firms. Production by subsidiaries abroad is, for many nations, expanding about twice as fast as production for the firms' own home markets. While the production volume, measured as Gross National Product, during the 1960s has expanded by some 4% per year in most countries, imports and exports have often increased by about 8% per year and production by subsidiaries abroad by some 10 or 2% per year.
>
> A similar internationalization of institutions is occurring in the markets for insurance, traveling, consulting and, perhaps most dramatically, money and credit, for instance by the development of international banks and other international credit institutes, such as those operating in the Eurocurrency and Eurobond markets.
>
> The 'geographical strips' on the world map which define the nations are, in other words, penetrated more and more by economic, technological and cultural forces. In fact, the expansion of multina-

tional economic organizations implies that the world is increasingly dominated by two quite differently organized entities: "geographically" defined national states, and "footloose" multinational organizations, such as firms, labor unions, and industrial organizations, built up along "functional" lines, such as industrial branches, or possibly as international conglomerates for a number of different economic activities.

Both Lindbeck and Johnson foresee mounting conflict between these forces. Lindbeck uses a phrase "death struggle" of the national state in the wake of ever-stronger international forces — adding that this is a vast exaggeration of the interaction. Johnson says that the "long-run trend will be toward the dwindling of the power of the national state relative to the corporation", and adds that "to survive as an effective influence, the political process will have to move in the direction of world government." He notes that the growing influence of the World Bank is a pointer in this direction. This line of thought leads directly to the concept of codes of conduct and international bargaining, such as we have been witnessing at the UNCTAD Nairobi Conference. I will return to codes later in this paper.

Wholly-Owned Affiliate

It is easy to understand why it is that the wholly-owned affiliate is the preferred form of technology transfer in the practice of the multinational corporations. Indeed, technology transfer is so much a part of a normal business of many American and European multinational corporations that it is difficult to discuss as an isolated topic. To be sure, there are variations in the style and the degree of professional attention devoted to this aspect of the business, the nature of the technology to be transferred being a dominant factor in the style and mechanism used. Very characteristic of the technology transfer is the communication network and movement of messages, the training methods, the personnel development, the mobilization of resources in problem solving, quality assurance, component standardization, and interchangeability. All these are features of a global production network which is made effective only by majority ownership, leading to overall central control of operations.

Lindbeck puts the point succinctly when he seeks the technological factors underlying the internationalization of the economic system. He writes[6]:

> On the technological side, the most important factor is perhaps that there seems to have been a bias in the technological development in favor of communication and transport, which has about the same effect on world trade as a fall in tariffs. Commodities and services which were not earlier profitable to trade internationally become profitable to trade when transportation costs fell relative to other costs.
>
> The fall in communication costs has occured not only in the transportation of commodities but also, and perhaps even more, in the communication of messages. The cost of leading organizations over large distances has fallen enormously as a result of developments in telecommunication and data technology. For the first time in history, it has been possible to direct effectively the operations of firms over the entire globe. This is probably one of the main explanations for the rapid expansion of multinational firms. Another technological factor which has boosted the expansion of international firms is that technology, by being more complicated, has also become more complementary than earlier to managerial skill. This makes it increasingly profitable to sell technology in combination with managerial skill, rather than selling technology separately, for instance by patent rights. In other words, it becomes more profitable to move packages of technology and managerial skill between countries, than selling the technological knowledge separately. And this "package" of technology and managerial skill is exactly what is provided by the internationally operating multinational firm. As we know, the package often also includes two other important components: capital and organization for marketing.

The essence of the matter seems to be this. Technology cannot be bought and sold and used as discreet packages. It may be necessary to modify this statement in the case of highly developed continuous process technology in which the control systems are embodied in the design; this type of technology comes nearest to being transferable as a package, but even this is not effectively transferred in package form. Many of the misunderstandings implicit in proposals for codes such as Pugwash and UNCTAD debates rest on a failure to accept that technology cannot be bought and sold as discreet packages. Technology is, after all, the way people make things or give services and it absolutely demands a favorable context for its survival and growth in a new location. The whole picture emerging from BIAC studies is one of continuous interchange of messages, of people, of engineering, of design, of new technology, between the production units of multinational enterprises. Moreover, this is not a gloss on the operation, it is the essence of it. This is why the multinational enterprises seek control of their overseas establishments, to permit this free flow.

Even the most sophisticated package, such as I have referred to above in the form of continuous process of highly developed technology, makes demands on its iontext if only on an upstream and downstream array of connections and some injections of skills and updatings in the technology. If we turn to something much more labor-intensive, like motor vehicle manufacture or exchange equipment technology, we find an enormous and well-organized training program — one which is ongoing to make the transfer take root and live. All this adds up to the technology not being a package. It demands the continuance of its links with the parents — or *with a foster parent*. When the license brokers sell technology of an I.C.I. to a Shell or B.P. they take a child of one parent and install it in the family of another where, incidentally, it may be better cared for and be more wanted than it was in his original home. By contrast the sale of technology to a government, or to a banker with no trained work force, managers, craftsmen or salesmen, cannot be expected to be an effective means of implanting the productive process in a new context.

Umbilical Cord

The Pugwash Code is written as though technology was a packet with a price tag (too high) and a quality label (too low): whereas technology is what a receiver makes of it and what the seller continues to give it. I therefore have a picture of the best practice technology being a dynamic

ORIGIN OF ICI POLYTHENE USED OUTSIDE THE UK %

	1950	1960	1970
Exported from UK	100	13.5	1.5
Manufactured overseas by ICI associates	0	8.0	15.0
Manufactured overseas by ICI licensees	0	78.5	83.5

Source: R. B. Richards, Chemistry & Industry, 1970 (7).

TABLE 9

system which needs to keep intact some umbilical cord with the body of world technology, without which it will atrophy.

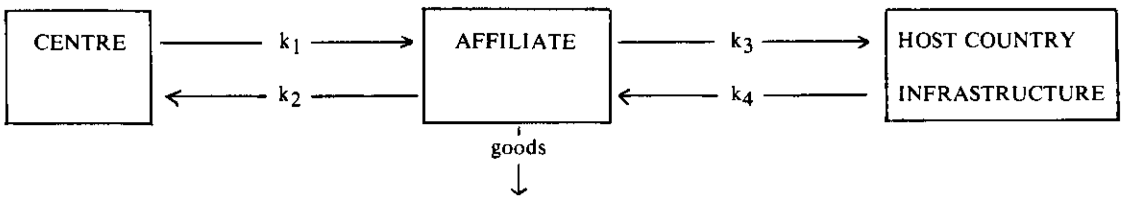
The great flush of technological advances experienced by industrial societies in the immediate postwar years has, in the sixties and later, given way to a new dimension — the movement of the technology to other locations and markets worldwide. There are many reasons why this should have happened. Domestic contraints on the acceptance of new technology coupled with escalating proving expenses, the perceptible if perhaps temporary, exhaustion of Pandora's box of exploitable inventions, limitations or embargos on imports to developing countries, the need to meet local competition on equal terms free from heavy transport costs, the need to have a presence in the market to understand customers' tastes and demands: all these push the home country-based MNCs toward added overseas production facilities.

A striking illustration of this trend is provided by the transfer of I.C.I's polythene processes for uses outside the U.K. R.B. Richards[7] writes: "Over the last 20 years the emphasis has changed from exports from production based in the U.K. to overseas manufacture, sometimes in association with other private companies or with a state-controlled corporation, and to the provision of technical information and, in some cases, patent rights, without there being any subsequent financial interest. This change of interest is well illustrated by Table 9 which shows how overseas manufacture of one important product has increased at the expense of direct exports from the U.K."

* * *

Given that technology transfer is the normal business of many U.S. MNCs, how does the process function? The flow of technology in an MNC has been likened to the flow in a two-way conduit pipe (Professor R. Hawkins). In one MNC HQ, I visited a single engineering department which dealt with 12,000 messages — letter, telephone, telex — each year from its affiliates. Such messages concern supplies, specifications, amendments and modifications, problem solving, quality and productivity. In my experience, these flows are not all one way (as some suppose) but much initiative is taken locally. Another MNC has an elaborate network which can call upon the expertise of any part of the system to aid another with a problem.

This is only one segment of the transfer process, the exchange and movement of messages and people *within* the MNC conduit system. Of crucial importance to the receiving or host country is the set of technical exchange transactions between the conduit pipes of the MNC affiliate and its social and economic environment. In other words we may see technology transfer from MNC to LDC using the affiliate method as



It is characteristic of the 100% affiliate transfer method that the flow rates k_1, k_2, are fast and relatively unimpeded (Michalet[8] observes that, thanks to modern communications, "distance is practically cancelled out"). But it is of little use to the host country that wishes to develop its economic and technological infrastructure to have very fast k_1, k_2 if k_3, k_4 are vanishingly small (although it must be conceded that the efficient production of goods is of basic importance to a developing economy, be these electric motors or telephone exchanges).

The object of much legislation and some proposed codes (such as Pugwash) is, ostensibly, to improve the flow by making it faster and cheaper and better. But it is of no avail to push to increase k_3 if the price is severance of k_1; and there are real dangers that this can happen.

Following are some of the mechanisms through which the exchanges k_3, k_4 can operate:

1. Supply of products
2. Interaction with local scientific and technological resources
3. Recruitment and training of people
4. Demands on suppliers
5. Technical service to the users of products
6. Training of dealer network personnel
7. Payment of taxes

Transactions (1) and (7) are clearly of the greatest importance. My observations are that (2) is only marginal in its effect on the host country; the major locus of such interactions are university technology-oriented departments and management groups, and this only where the receiving economy is an industrialized one.

The effect via (3) is significant; one U.K. affiliate "claims" to lose 25 to 50% of apprentice recruits, a Nigerian one 20%. These flows of trained people back into the business context after training are valuable additions to the technical strength of the developing infrastructure.

Martin Jones[9] makes the point, *a propos* the transfer of process and chemical technology to less-developed countries, that mechanical engineering is the key activity from which all the engineering skills relevant to the transfer can be developed. For this reason plans should be formulated to develop mechanical engineering skills at an early stage and he suggests negotiations with a foreign engineering company aimed at manufacturing facilities for the purpose of providing a base load of jobs through which mechanical engineers in the LDC may receive practical training. As examples, Jones suggests some key products including:

heavy engineering (pipeline manufacture)
medium engineering (centrifugal pumps)
light engineering (fabrication of individual components)

Such operations should have a training function in providing experienced engineers for the key manufacturing sectors.

The major impact of the affiliate on its environment is likely to be via (4). Even in a "developed" host country the demand for performance and quality embodied in a U.S. specification can be a big challenge which, if it is met, greatly improves the capability and the sales potential of the supplier. This effect is most marked in the engineering and manufacturing industries where component parts are supplied locally. I have encountered examples in my studies where the impact of the transferred technology has produced substantial upgrading of the supply of welding equipment available locally and also of the quality of materials.

Technical Service

Technical service (5) is greatly strengthened by the conduit system which taps the worldwide resources of the MNC; for those technologies that rely on dealers for the day-to-day job of service to users the importance of (6) is evident. The training support material I have seen on my visits is impressive, leaving academia well behind in its thoroughness and quality.

There are grave dangers in basing technology transfer policy decisions on inadequate understanding of the problem (UDIS[10]). While avoiding such an error one may safely argue that interaction (4) is the one to be encouraged if the host country seeks to extract beneficial effects from technology transfer for its economic and social infrastructure. An approach to this encountered in my study is the demand by one host country that the local value added to the product of the received technology should, within a specified period, reach 70% of the total value. In setting such targets, of course, it may be expected that there will be some loss of quality of product; but this price may be acceptable in support of the long-term goals of an LDC.

Michalet[8] recently offered three scenarios for the future pattern of technology transfer developments "branch affiliates", "workshop affiliates", and decomposition of the MNC international networks. The "turn-key" is symptomatic of the drive toward the third of these scenarios.

The turn-key operation, by which one understands the transfer of a technological package, is one in which the total design and construction is severed from its parent company once the key has been turned and the system begins to operate. The very concept of turn-key flies in the face of the relationship of technology to its context and is based on the insistence on regarding technology as a package, a phenomenon to which I have already referred. Aside from the implicit built-in decay of the technology which cutting off from the international roots will ensure, the insistence on turn-key operation implies for the receiving country a foregoing of the very important learning process which is involved in the training and continued working with the providers of the technology and their technologists and managers. The whole concept of turnkey is in strong contrast with the recommended procedure in the quotation I gave earlier from Martin Jones, where the installation of industries using mechanical engineers was advocated as a means of providing training opportunities for indigenous personnnel; effective training requires continuing contact with the technological source.

To illustrate the point I quote from a forthcoming book by Behrman & Wallender[11]. They write:

> In straight sales of technology, the recipients have little information regarding how the supplier views the initial problems of use of manufacturing technology and why it recommends the ultimate techniques or machinery and equipment that are transferred. If the receiver were carried through the initial proposal and planning stages, he might be more willing to sacrifice certain elements of the technology package to gain others, in order to adapt more effectively the technology to his own needs and objectives. Where technology agreements are derived from bargaining situations, rather than out of wholly-owned relationships, the competitive position of the supplier and receiver often preclude any cooperation at the preliminary planning stages. Consequently, the short-term focus on "low cost" and a "good deal" in economic terms may be shortchanging both parties in terms of the total technology transferred for the long-term success of the project.

Despite its manifest deficiencies, there is no denying that this method of transfer is coming into greater demand and two of my seven collaborating companies gave evidence to this effect; neither of them viewed the development with any approval. Several of my collaborating companies had experienced transfers to the centrally controlled economy countries, some turn-key, some with contract to supply the know-how, supervise the construction of plant and train the manpower. The latter method is much to be preferred but even it leaves much to be desired so far as one hears complaints from the centrally-controlled economy countries that their technology acquired in this way fails to "takeoff" and become self-supporting in the way that they would wish. Again one is experiencing what I regard as very natural and not surprising withering away of the technology by cutting it off from its lifelines to international bodies.

Even if, in the very long terms, Michalet's third scenario is the true picture, I agree warmly with Behrman & Wallender that LDCs do themselves and their long-term goals a disservice by foregoing the learning opportunity offered by technology development through MNCs and their affiliates; a loss which is a concommitant of adopting the "turn-key" approach.

The theme of learning by participating in the transfer process is developed in a recent paper by Bell & Hill,

(Continued on Page 171)