

Multinational Enterprises Programme

Working Papers

Research on Employment Effects
of Multinational Enterprises

Working Paper No. 19

Technology and Third World Multinationals

by Louis T. Wells, Jr.

Harvard Graduate School of

Business Administration.

Geneva, International Labour Office, 1982

Copyright (c) International Labour Organisation, 1982

This is one of the working papers prepared for an ILO study on the development by multinational enterprises of appropriate technology for maximum employment creation in developing countries, undertaken by the ILO's Multinational enterprises programme. Responsibility for the opinions expressed in the working papers rests solely with their authors and does not constitute an endorsement by the ILO of the opinions expressed in them. The working papers are intended to provide elements for further discussion of the subjects treated.

Other studies dealing with the subject of appropriate technology and employment creation are Working Papers Nos. 14, 16, 17, 21, 23 and 25 which are listed in the Appendix.

TECHNOLOGY AND THIRD WORLD MULTINATIONALS

Louis T. Wells, Jr.*

CONTENTS

	Page
I. Introduction	1
II. Characteristics of Technology	4
Flexibility	13
Use of local materials	18
III. Implications	20
Table 1	25
Table 2	26
Table 3	27
Footnotes	28

*Professor of International Management, Harvard Graduate School of Business Administration.

Sections of this paper have been adapted, with permission of the publisher, from the author's forthcoming book on Third World Multinationals (tentative title), to be published by The MIT Press. The underlying research was largely financed by the National Science Foundation, Grant No. PRA78-10238.

Only recently noticed in the literature on multinationals, foreign investors from developing countries are spreading technologies that are different from the technologies usually available from the multinationals of the industrialized countries. Third World multinationals offer technology that contributes to host countries' employment objectives, saves on capital, and reduces, in many cases, bills for imports. Although they represent a desirable form of south-south cooperation, what they offer is not more attractive on every score than that which can be obtained from multinationals from Japan, Europe, or the United States. For a host country with a choice, the decision is not an easy one. Economic objectives and political concerns must be carefully weighed.

A decade or so ago, the fact that foreign investors from developing countries offered different technologies from those offered by firms from the advanced countries would have mattered little. There were so few such investors that their impact on employment or other concerns in host countries could not have been felt. In recent years, however, the number of multinationals based in developing countries has been growing very rapidly. Although there are no reliable published measures of the total investment flows accounted for by such firms, data collected for a study that I have been conducting are suggestive. I have identified almost 2,000 subsidiaries of such firms.¹ About half the subsidiaries are for manufacturing. The actual number of such investments must be three or four times this number.

For some host countries such as Indonesia² and Thailand, subsidiaries of parents from other developing countries account for a large fraction of foreign projects. In these countries, the impact of the technology associated with multinationals from developing countries is already significant.

The activities of Third World Multinationals are limited largely to the developing countries. About 95 percent of the manufacturing subsidiaries that I identified are in other developing countries. The majority of the subsidiaries are located in countries that are clearly less developed than the countries in which the parent firms reside.

Most of the investment is regional. By far the largest sources of such investments are in South and Southeast Asia. Southeast Asian parents have located most of their subsidiaries within Southeast Asia. Indian firms have invested around the Indian Ocean. Investment flows to countries that have been targets for manufactured exports in the past and, in many cases, which have ethnic groups similar to those of the parent countries: overseas Chinese and Indian, particularly. In Latin America, investments flows are smaller, reflecting the lower level of regional trade in manufactured goods. Argentina spawned multinationals early in this century, with subsidiaries largely in Brazil, Uruguay, and Chile. Mexican firms have gone to other Latin American countries more recently. And most recently, Brazilian firms have begun to establish foreign subsidiaries. Although most Brazilian subsidiaries are in South America, a few are in place and more planned in Africa, a recent target for Brazilian exports. Other Latin American countries have generated only a few foreign investors.

Data for this research were collected from published sources and from interviews with enterprises in Hong Kong, the Philippines, Indonesia, Thailand, India, Pakistan, Sri Lanka, Mauritius, Peru, Argentina, Brazil, and Mexico. The most complete data come from Indonesia and Thailand.

II. Characteristics of Technology

Labor intensity

The most striking characteristic of the technology transferred by firms from developing countries is its labor intensity.

For the firms examined, the pattern is clear. The simplest kind of comparison contrasts the capital-labor ratios for subsidiaries of parents from developing countries with those of subsidiaries of parents from industrialized countries. In Indonesia, the first group uses, on average, only \$8,500 of capital for each worker employed; the second group, \$16,300. The differences do not result from the dominance of Chinese investors. Table I breaks down the data further by nationality of investor. It is apparent from the table that investors from developing countries, whatever their nationality, use more labor intensive techniques than do investors from the advanced countries.

The observed differences could, of course, result from differences in the industries in which the various investors are found. Firms from developing countries might be attracted to industries that are inherently more labor intensive than those that attract firms from the advanced countries. But the data suggest that the two types of firms do use different technologies, even within the same industry. A breakdown of investment by industry allows a more careful comparison of firms originating from different countries. When the original Indonesian industry classifications are used, there are eight 2-digit industries that contain subsidiaries of parents from both developing and industrialized countries.

In all eight industries, the capital-labor ratios of the plants with parents from other developing countries are lower than those of their counterparts from the industrialized countries. In only one case (31, food and beverages) was the difference less than 35 percent. A finer breakdown of the data shows the same results. At the 3-digit industry level, the average investors from other developing countries are more labor intensive in 13 out of 14 industries that have two or more of each group of firms. The exception is in food products.

Not surprisingly, the figures for investment in machinery per employee show a pattern similar to that for total investment per worker. The developing country firms invest less per job created (Table 2). Nevertheless, the differences seem to be less significant than for the overall capital-labor figures. In five of the eight industries, a comparison of the value of machinery per worker for the firms from other developing countries and the firms from industrialized countries indicates less difference than do the figures for total capital per worker, even though the differences are still substantial. One might anticipate smaller differences for the machines per worker figure. The total investment reflects working capital and building, both of which might not vary with the technology used. If one were to expect some difference, the expectation might be that the total investment would be larger for a labor intensive factory because of the need for a larger building to house the greater number of workers, or because of the need for more working capital, a need resulting from having for more work in process and the

necessity of meeting large, regular wage bills associated with a large labor force. The unexpected results could arise for either of two reasons: One possibility is that investors from other developing countries spend less on building than do their industrialized counterparts. This does seem to be the case, as other data suggest. Another possible explanation of the pattern is that the firms from developing countries invest less, rather than more, in working capital. The fact that fixed assets are a slightly higher percentage of total investment for the investors from developing countries suggests that they do have less working capital. Since one would expect that labor intensive technology would require more working capital than would capital intensive techniques, I suspect that there may be a slight tendency of investors from developing countries to underestimate their working capital needs in the official application forms, which were the source of the data. My guess is that the results are explained by; less investment in buildings by firms from developing countries and a slight tendency on their part to underestimate the required working capital.

One study examined the technology used by investors from other developing countries in Thailand, carried out using sophisticated techniques.³ Since output data for each firm were available for that country, it was feasible to estimate production functions for twelve 4-digit industries. The results effectively demonstrate that foreign investors from other developing countries use more labor-intensive technology than that used by either Thai firms or foreign investors from the industrialized countries.

Small-scale

Third World multinationals typically transfer technology that is particularly suited to manufacture at small volumes. Labor intensity and small-scale are closely associated. Nevertheless, thoroughly convincing data to demonstrate scale adaptation are a bit more difficult to assemble.

The extent of the export of small-scale technology by developing-country investors is striking in the case of Thailand. Capacity utilization provides the first hint. Multinationals from the advanced countries operated at only 26 percent of their capacity, on average. In contrast, foreign investors from other developing countries were operating at 48 percent of capacity. The role of scale is verified when the outputs of the plants of various nationalities are compared. The average size (with the industry norm as 100) of a plant owned by an industrialized country parent was 190; for a developing country parent, 90.⁴

In another study by the same investigator, a group of foreign investors from ASEAN (Association of Southeast Asian Nations) countries was compared with multinationals from wealthy countries. Using index numbers again, the size of the ASEAN subsidiaries averaged 46, with the size of counterparts from the industrialized countries averaging 109.⁵

A study of exports of technology provided additional support for the contention that firms in developing countries innovate small-scale technology.⁶ That study covered exports of capital equipment from two Eastern Asian developing countries. It demonstrated that the country's advantage in such exports appears in sales of equipment that is for small-scale plants.

In interviews for my study, managers were asked how the sizes of their home plants and their subsidiaries would compare to the size of typical plants in an industrialized country. The typical answer was "smaller." The following data illustrate the sizes of the subsidiaries of firms that were interviewed. Hong Kong managers reported, as evidence, the number of looms for five weaving subsidiaries: 3,000, 1,920, 440, 250, and 200. One Argentine firm indicated 169, 240, and 168 looms in its Brazilian mills.⁷ Hong Kong firms reported the number of spindles for seven spinning subsidiaries: 110,000, 100,000, 40,000, 23,000, 16,000, 14,000, 10,000, 10,000. Two Indian firms reported 30,000 and 20,160 spindles in their subsidiaries. The Argentine firm had 14,700, 29,800, and 11,500 spindles in its foreign factories.⁸ By the standards of the industrialized countries, these are almost all small plants.

The two largest weaving factories and the two largest spinning facilities (in Malaysia and Thailand) all belonged to Textile Alliance Limited, a firm at the time 45 percent owned by Toray of Japan and highly integrated into the international network of that multinational. Because of its ownership, Textile Alliance was a firm that was included in the study with some hesitancy.

More evidence of the comparatively small size of factories owned by foreign investors from developing countries was provided by foreign investors in Nigeria and Indonesia. Sizes of textile plants were compared by origin of the owners. In Nigeria, the firms owned by nationals from other developing countries were, in most cases, smaller than the subsidiaries owned by European, American, or Japanese parents.⁹

In Indonesia, factories for flashlight batteries show a similar pattern. A Singapore-owned (with **Chinese technicians**) factory had a capacity of 12 million batteries per year on a one-shift basis. In contrast, an American-owned factory in Indonesia could produce more than 65 million batteries in the same period.¹⁰

Although the interviews and other data for certain countries pointed out the role of small-scale technology in foreign investment by firms from the developing countries, the point is not always easily evident in some aggregate data from particular countries. Consider Indonesia, for which a great deal of information was available about investors of various national origins. At first glance, the Indonesian data suggest that the differences between developing and advanced countries are not as suspected, or at least not great (see Table 3). However, the overall figures are misleading. A disproportionate number of the subsidiaries of parents from developing countries are for food processing. They are among the largest projects in the group. When one examines the investments by industry, a clearer pattern begins to emerge. Out of eight 2-digit industries with both types of investors (developing country and industrialized country), the average subsidiary of a developing-country parent has less investment in six industries. (The exceptions are in "food, beverages, and tobacco" and in "stone, glass, and similar products," which contain only two developing-country projects.) In two of the industries (Indonesian 32 and 34; "textile and paper products"), the average subsidiary of a developing-country parent is considerably less than half the size of its competitors from industrialized countries. In the remaining cases, the difference is

at least 30 percent. When the industries are broken down more finely, at the 3-digit level, the results are similar. Out of 14 industries with two or more of each type of firm, the average firm from another developing country is smaller in 11 cases. As in the case of labor intensity, the exceptions are all in food and beverages, where market size is probably not a major constraint.

Since differences in capital-labor ratios mean that factories with smaller total investment may actually have larger output, the plants should be compared in terms of production capacity. Unfortunately, neither output nor capacity data were available for Indonesian firms. If the employment figures were also smaller for the developing-country firms, then one could feel confident in claiming that the plants were indeed smaller even in the absence of data on volume. Unfortunately, the data are not thoroughly convincing on this score. In 15 of the 22 3-digit SIC industries, firms from other developing countries had fewer employees than their competitors from advanced countries; but 7 ran the other way.

Data from several other countries and firm interviews provided strong support for the contention that the two types of investors do build plants of very different sizes.

Most of the parent firms had acquired their original knowhow from the advanced countries, in many cases through licensing agreements with multinationals from Europe, the United States, or Japan. With time, however, they had adapted the technology to local market conditions.

The extent to which foreign technology can be adapted was pointed out by Indian firms with foreign investments. Of 52 Indian parent firms interviewed, 42 reported having obtained their original technology from abroad. But 47 also reported that over half of their technology was "indigenous" by the time of the interview. One Indian firm that processes edible oil illustrates the pattern. It began operations in India in 1917 with copra crushing equipment imported from the United States. By 1976, it was using entirely Indian equipment. In this and other cases, the local equipment was not slavishly copied from the earlier imported machinery. Rather, changes were made in response to Indian conditions. The locally adapted technology was eventually exported to foreign subsidiaries, as is apparent from the fact that "Indian machinery" was the source of knowhow in most of the foreign investments for which data were available.

The firms interviewed had adapted technology in many ways to adjust to small scale. Where larger plants consist primarily of duplicate pieces of equipment, little innovation is required. Such is the nature of spinning and weaving plants. In other cases, adaptation to small scale means the substitution of batch processing for mass production. Illustrative would be the manufacture of paper containers in short runs, as done by Packages Limited of Pakistan, or the batch manufacture of pharmaceutical products by a Philippine firm. This approach, common among developing-country firms, requires quite different management skills from those typical of mass production techniques. A less drastic change occurs when assembly lines are dropped and semi-finished products are moved in batches from work station to work station, as is done by several manufacturers of flashlight batteries located in Indonesia. On occasion, labor may be

substituted directly for machines. Thus, steel auto bodies may be fashioned by hand. Jeepney bodies in the Philippines, for example, are much more suited to hand manufacture than are bodies of typical North American automobiles. The Jeepney body substitutes simple bends for the curves typical of auto bodies in the richer countries. Similarly, a Hong Kong firm redesigned appliances to use fewer moulded plastic parts. On occasion, the adaptation of the manufacturing process to small scale may involve a completely different technology, such as the use of fiberglass instead of steel for the auto body. In some cases, factories for small scale manufacture use machinery that has been especially designed for lower output levels. A carpet maker in the Philippines uses 16-inch looms, while a U.S. firm reportedly would use approximately 200-inch looms. Some factories rely on multipurpose machines to manufacture at small volumes. Thus, parts may be made on standard lathes or bent with simple equipment that can be kept busy by making various products. One firm planning for a capacity of 20,000 refrigerators per year chose multipurpose equipment for the production of cabinets. The machines could be adjusted for various models of refrigerators and for other appliances. Finally, workers may be less specialized. A worker may be used, much like multipurpose machines, for a number of tasks in the production process, rather than for one task to be repeated day in and day out.¹¹

The small scale technology used in the foreign subsidiaries of a developing-country firm was not always that in use in the home plant at the time the investment was made. As wage rates have risen in Hong Kong,

for example, labor intensive machinery appropriate to conditions in Hong Kong a few years earlier has been replaced with more automated equipment. Several firms exported old machinery to various affiliates. A complete plant was, for instance, moved to Ghana for textile manufacture. By 1979, a Brazilian bicycle manufacturer had a large scale factory at home, but it had only recently established a small subsidiary in Bolivia. Managers pointed out that less than ten years had passed since the parent company had been producing at a similarly low volume in Brazil. The technology was still familiar to the firm's managers. On the other hand, it had been several decades since firms from the industrialized countries had manufactured ordinary bicycles in small volumes. In many industries, the techniques appropriate to small scale have long been forgotten in Europe and the United States. Although the Brazilian firm's small scale technology was outdated at home, in the small Bolivian market it was quite appropriate, and not easily available from the advanced countries.¹²

Flexibility

One of the important ways used by firms in developing countries to adapt to small size markets is to build flexible plants, setting them up so that they can produce a wide range of products or product models. Since one specialized model or version of a product is unlikely to have a sufficiently large market to keep certain machines fully occupied, machines are designed or chosen for their flexibility. Thus, Packages Limited of Pakistan has carefully studied the downtime involved in product changeovers for various kinds of European machinery used for making paper packages.

Similarly, a Hong Kong appliance maker has selected sheet metal working equipment that can be used for various models of both stoves and refrigerators. The manager of a Hong Kong textile firm with spinning facilities in Indonesia explained his use of "small package spindles," which are more labor intensive than the usual spindles, requiring more loading and unloading, but "more flexible." A manager from a Southeast Asian pharmaceutical firm reported making as many as 400 products at home and 50-100 products in the company's foreign subsidiaries. In such plants, the firm "must use the same equipment for many products."

In their efforts to design flexible plants, the firms from developing countries occasionally build a special kind of excess capacity into their plants. The factory design includes extra machines required to produce special models or versions of the basic products even though those machines may stay idle much of the year. The Hong Kong textile manager just quoted explained that he did "not expect every piece of equipment to be used all the time." In another case, Packages Limited, the factory had a simple machine to make paper cups. The machine was used only occasionally, since the principal customer for paper cups, the Pakistani national airline, did not order enough to keep the machine fully occupied. Nevertheless, paper cups and similar products were needed to fill out the company's line and to keep other machinery busy.

In some cases, the design of a flexible, small scale plant depends largely on knowing well equipment available from a large number of suppliers in the industrialized countries. A German machine for one step may be combined with an Italian one for the next operation. A few firms in the developing

countries have made the large investment required to investigate carefully a wide range of such equipment. Not only have they collected specifications; they have also tried the equipment for reliability and they know the availability of spare parts. Once acquired, such knowledge is useful in other small markets. The contrast to the multinational from an advanced country is particularly well illustrated by an Indian firm that acquired the sick Indonesian subsidiary of a U.S. investor. One major change, according to the Indian managers, was to redesign the plant to make short runs of many products, rather than the long runs of standard products for which it had been built. (Further changes involved lowering overheads.) When the firm was interviewed, it was operating only 100 of the 260 looms installed by the Americans. The 100 being used were of three different types. These machines were used intensively. The Indian owners were running 3 shifts 7 days a week, in contrast to the U.S. owners who ran only 5 days.

The extent of special knowledge possessed by some firms from developing countries is illustrated by another firm interviewed in connection with this study. It had drawn up a list of suppliers for various pieces of equipment. The list covered a wide range of European suppliers. The capacity of each piece was recorded, as was the cost and set-up time required to adjust it for other kinds of output. The machinery manufacturers were evaluated according to their delivery and service records; the machines, according to their needs for maintenance. For setting up operations in other countries with small markets, the firm had valuable information.

To meet the needs of small scale manufacture, a number of firms in developing countries have manufactured their own machinery. Where special machinery was used by the companies interviewed, it was usually made by the enterprise that operated it, not by specialist machinery manufacturers. Typically, a firm started at home with all, or almost all, imported equipment. As it expanded or replaced imported machinery, the experience gained by its technicians enabled it to supply more of the technology and machinery internally.¹³

The pattern illustrated by Packages Limited of Pakistan was frequently encountered in other firms. The original plant in Pakistan began with equipment acquired in Europe. But spare parts were expensive by the time they reached Pakistan. And lead times in acquiring them were such that repairs could not be made quickly. Moreover, some of the original equipment was second-hand and quite old. For this machinery, parts were not available easily, even in Europe. Since local shops were unable to make needed parts quickly and reliably, the firm established its own machine shop and foundry. But the shop had excess capacity as long as it supplied only spares. To use capacity, the shop operators began to experiment with modifications to the original machinery that might improve its performance. Such modifications were, in some cases, to increase flexibility: generally by decreasing set-up time. Gradually, the shop began to copy the imported machines, but with modifications that were useful for short runs of many products. Eventually, the shop was producing a number of machines largely of its own design, with special features in response to local problems. As Packages ventured outside Pakistan, it provided its foreign affiliates with machinery of its own manufacture.

Given what is now known about the importance of a close link between the user of capital equipment and the supplier if successful innovation is to occur,¹⁴ it should perhaps not be surprising that the adapted equipment is so often made "in-house." As a result, very few firms that were principally machinery manufacturers were involved in the foreign investments uncovered in this study. To sell innovative machines abroad, machinery manufacturers might well have to take equity positions in the facility that would use the machinery. The infrequency of foreign investments by firms that were primarily machinery manufacturers suggests that they might not have been as innovative as some of the equipment users who felt pressing needs for changes in the machinery.

Machines newly manufactured at home or in the host country and carefully selected new machinery from the industrialized countries are not the only sources of small scale equipment for foreign investment by firms from the developing countries. Second-hand machinery provides an important alternative.¹⁵ Such machinery was, in most cases, manufactured in an industrialized country, but at a time when the market there was smaller or before technological change had increased the optimal scale for the high wage country.¹⁶

Interviews identified a large number of subsidiaries that operated some used machinery. Machinery formerly used in Hong Kong has been located all over Southeast Asia and as far away as West Africa.

In most cases, old machinery is more flexible than new; nevertheless, newer machinery is occasionally more flexible; for carpet weaving, recent innovations in

electronic controls increase flexibility, according to the manager of one firm interviewed. Although applications of electronics to machinery may make this kind of case more common, in the late 1970s, it seemed that "old" usually implied "flexible."

Like other ways of producing at a small scale, the use of second-hand machinery is usually more labor intensive than manufacture with large-volume technologies. The labor intensity associated with older machinery is illustrated by data from the textile industry. Spinning equipment of 1950 vintage has roughly half the output per man hour of 1968 equipment, for example.¹⁷

Use of local materials

Although there are no aggregate data to support the point, impressionistic evidence from literature and interviews suggest that multinationals from developing countries are more likely to use local materials than are multinationals from the industrialized nations. Firms were encountered that transferred abroad knowhow that used local materials for glue and paper manufacture, for example. Well known is the transfer of Brazilian and Mexican steel technologies that use charcoal or gas instead of imported metal-grade coal.

In some cases, firms have used their research labs to adapt to the use of materials which are available where they locate subsidiaries but which are different from what they use at home. Thus, an Indian firm adapted its cement-making processes to use coral sand available in Mauritius. It seems that a second adaptation is easier for the firm that has already adapted once to the use of non-standard inputs.

Thai data¹⁸ provide some evidence that the adaptation by Third World multinationals is greater than that undertaken by competitors from other nations. Factories owned by parents from other developing countries imported 39 percent of their raw materials; factories owned by Thais, 65 percent; factories owned by multinationals from industrialized countries 76 percent.

III.

Implications

Third World multinationals have a great deal of appeal, and not only on narrow economic grounds. They represent a significant and growing forum of south-south cooperation. They offer competition to the traditional multinational firms in certain industries, a rivalry that can lower the cost of technology. Moreover, they offer a way for a host country to diversify its sources of investment. By encouraging firms from other developing countries, a host country can loosen its dependency of a small number of industrialized countries. Nevertheless, Third World multinationals have not received an unambiguous welcome in every potential host country. Some of the reasons are economic; some, political.

Third World multinationals score well in creating jobs in the manufacture of products for the local market. But they do not do so well in providing export markets, with one important kind of exception.¹⁹ Restrictive policies and small market size at home mean that they cannot export to markets that they know or control. There is some offset in the fact that they are likely to import less materials and components, as has been pointed out. Further, some shaky data suggest that they remit less of their earnings than do multinationals from advanced countries. Still on the positive side, they are more likely to share ownership with local partners (less than 10 percent of the manufacturing subsidiaries identified in this study were 95 percent or more owned by their foreign parent). They are more likely to compete on price rather than on brandname. On the negative

side, interviews suggested that they **appear more prone to make illicit** payments to government officials. Moreover, reliable data clearly indicate that they keep more expatriates in management and technical jobs in their subsidiaries than do multinationals from the industrialized countries.

The economics are confusing enough. But political issues are also not straightforward. In some potential host countries, foreign investors from neighboring countries grate on ethnic sensitivities. Much of the investment within Southeast Asia is by ethnic Chinese from **countries like Hong Kong, and Singapore**. In some of the host countries, more control of the business sector by Chinese, no matter what their nationality is viewed suspiciously. Similarly, investment from the Indian subcontinent can raise domestic political issues in East Africa. Even where ethnic sensitivities are not great, regional rivalries make for problems with investment from powerful nearby countries. In Central America, Mexican firms are not necessarily viewed as more politically acceptable than U.S. firms. Similar problems exist between Argentina and Brazil, for example.

The relevant comparison for host governments is not always between Third World multinationals and multinationals from the industrialized countries. Firms from other developing countries are particularly prone to invest in just those activities that local entrepreneurs will soon be ready to undertake. Their projects are largely in sectors with mature technologies. (A comparison of U.S. industry's R&D expenditures in sectors containing many Third World multinationals and those containing many multinationals from advanced countries shows the difference clearly.²⁰) Host governments must

face a difficult decision: import appropriate technology through foreign investment now or wait for a domestic firm to undertake the project and, presumably, begin again the process of adapting technology from the industrialized countries.

Where the choice facing a government is between a Third World multinational and a firm from an industrialized country, one could wish that the best of both kinds of firms could be combined. The choice facing host countries would be more attractive if multinationals from the industrialized countries would use technologies similar to those transferred by the Third World multinationals. The example set by these firms, however, is not likely to have a significant impact on the rich country firms.

Remember that the skills transferred by Third World multinationals are not, with rare exceptions, the product of adaptations carried out by the enterprise to meet the needs of their host countries. Rather, these innovations are the results of the needs of the firms to innovate in certain ways to survive in their home markets. It was their small home markets that led them to find ways to produce efficiently at small volumes. Similarly, import barriers and long lead times for imported inputs at home pushed them toward finding ways to use locally available materials. They went abroad with technology appropriate to their host country only because that was what they had developed at home.

Most multinationals from the industrialized countries have behaved similarly, but with different results. When they have established manufactured plants in developing countries, they have usually brought the technology that they used at home. That technology was designed for large

markets and high wage costs. Moreover, coming, as they usually have, with brand names and differentiated products, the firms viewed the benefits from modifying technology to lower costs as being small, compared to the rewards from more effort on pushing on to a new product or more spending on brand names. In fact, if they were to adapt technology, they would face the risk of spoiling brand name images with products that were of less predictable quality than could be assured with the familiar technology.

There is, perhaps, some hope for gradual change in the future. Whenever products mature, competition usually accelerates. The response of traditional multinationals, when innovation or branding fails to fend off competition, is to slough off old products. Recently, however, the product cycle seems to be shortening, due partly to the increasing number of multinationals. In the new environment, some multinationals may find it more rewarding to try to extend the profitable period at the end of their product cycles by reducing costs, than to come up with new products and technologies that enable them to move to the beginning of new cycles. If multinationals from the advanced countries do see substantial gains in remaining with mature products by lowering manufacturing costs, some are likely to use increasingly small scale, labor intensive processes and rely more on local materials. After all, with subsidiaries in a number of developing countries, such firms could spread the costs of adapting technologies across a number of plants. Others, with an alternative strategy, will probably try to increase scale with specialized plants in different countries that trade parts and assembled products. The dominant strategy will depend on how restrictive trade policies become in developing countries.

Rather than undertaking their own adaptations, some multinationals from industrialized countries have formed joint ventures with multinationals from developing nations for operations in third countries. Typically, the firm from the industrialized country provides marketing skills; the Third World multinationals, knowledge about business in developing countries and, sometimes, technology. A few such joint ventures were identified in this study. Joint ventures between the old and the new types of multinationals may well become more common and may, on occasion, offer the host country some of the advantages of each kind of multinational.

Table 1

Average Investment in Manufacturing Subsidiaries
in Indonesia by Nationality of Investors

1967-1976

Nationality of Investor	Average Total Investment (\$ '000)
Chinese*	2,722
Other Southeast Asia	960
Other developing countries	3,935
Japan	5,687
United States	2,403
United Kingdom	1,189
Other industrialized countries	2,063

* In particular Hong Kong and Singapore.

Source: Calculated from data on realized projects from the
Indonesian Investment Board

Table 2

Machinery Investment per Worker in Manufacturing
Subsidiaries in Indonesia by Nationality of Investors
1967-1976

Nationality of Investor	Average Machinery Investment
	(\$'000/worker)
Chinese*	4.42
Other Southeast Asia	2.92
Other developing countries	4.89
Japan	8.14
United States	5.37
United Kingdom	5.34
Other industrialized countries	7.14

* In particular Hong Kong and Singapore.

Source: Calculated from data on realized projects from the
Indonesian Investment Board.

Table 3

Average Investment in Manufacturing Subsidiaries
in Indonesia by Nationality of Investors

1967-1976

Nationality of Investor	Average Total Investment (\$ '000)
Chinese*	2,722
Other Southeast Asia	960
Other developing countries	3,935
Japan	5,687
United States	2,403
United Kingdom	1,189
Other industrialized countries	2,063

* In particular Hong Kong and Singapore.

Source: Calculated from data on realized projects from the
Indonesian Investment Board

Footnotes

- 1 The data exclude subsidiaries whose parents are located in the usual tax haven countries, financial flows from oil surpluses, and Hong Kong parents which are run by ethnic Britishers.
- 2 There, subsidiaries of developing country parents account for 31 percent of all foreign subsidiaries outside mining and petroleum; 21 percent, by value.
- 3 See Donald Lecraw, Choice of Technology in Low-Wage Countries: The Case of Thailand, doctoral dissertation in Business Economics, Harvard University, 1976 and "Direct Investment by Firms from Less Developed Countries," Oxford Economic Papers, November 1977, pp. 442-457.
- 4 These and other results are reported in Donald Lecraw, "Direct Investments..." op. cit.
- 5 Donald Lecraw, "The Internationalization of Firms from LDC's: Evidence from the ASEAN Region," in Krishna Kumar and Maxwell McLeod (eds.) Multinationals from Developing Countries (Lexington, MA: D.C. Heath & Co., 1981).
- 6 Yung W. Rhee and Larry E. Westphal, "A Note on Exports of Technology from the Republics of China and Korea," mimeo, no date (after 1976), p. 10.
- 7 See 1973 Annual Report of Santista Textiles.
- 8 Ibid.
- 9 C.N.A. Nambudiri et al., in Kumar and McLeod, op. cit. The study did not clearly distinguish operations owned by foreign firms from operations owned by entrepreneurs of foreign ethnic stock.
- 10 Louis T. Wells, Jr., "Economic Man and Engineering Man," Public Policy, Summer 1973.
- 11 For a summary of approaches to down-scaling, see R.B. McKern, "Working Paper," for Experts Meeting on Down-Scaling and Adaptation of Industrial Technology, 27-29 June 1977, OECD, Paris.

- 12 For a number of examples of small-scale technologies that have generated foreign investment in Latin America, see Eduardo White, "The International Projection of Latin American Firms," in Kumar and McLeod, op. cit.
- 13 See Ashok Desai, "Research and Development in India," Margin, January 1975, p. 90.
- 14 See Nathan Rosenberg, Alexander Thompson, and Steven E. Belsley, "Technology Change and Productivity in the Air Transport Industry," NASA Technical Memorandum 78505, Moffett Field, Calif. September 1978, and Nathan Rosenberg, "Learning by Using," Stanford University, mimeo, n.d. See also Henry J. Bruton, "On the Production of Appropriate Technology," Research Memorandum Series, No. 13, The Center for Development Economics, Williams College, December 1979, pp. 42-48.
- 15 The relation of scale to used equipment is explored in Dilmus James, "Used Automated Plants in Less Developed Countries: A Case Study of a Mexican Firm," Interamerican Economic Affairs, Vol. 27, No. 1, summer 1973.
- 16 The characteristics of second-hand machinery are complex. An interesting study of second-hand jute processing equipment points out that such equipment appears on the market at various times for a number of reasons: changes may occur in machinery technology, product demand may shift, maintenance costs may become too high for a high-wage country, and so on. See Charles Cooper and Raphael Kaplinsky, "Second-hand Equipment in a Developing Country: Jute Processing in Kenya," Discussion Paper No. 37, 1973. See also Howard Pack, "The Optimality of Used Equipment: Calculations for the Cotton Textile Industry," Economic Development and Cultural Change, January 1978, pp. 307-324.
- 17 See R.B. McKern, "Working Paper for the OECD Development Centre Exports Meeting on Down-scaling..." op. cit.
- 18 From Donald Lecraw, "Choice of Technology..." op. cit.
- 19 The important "offshore" firms from, primarily, Hong Kong and Korea do provide access to export markets in the advanced countries. They have set up subsidiaries elsewhere to supply old customers when quotas or high labor costs at home have limited their opportunities. See Louis T. Wells, Jr., "Foreign Investment from the Third World: The Experience of Chinese Firms from Hong Kong," Columbia Journal of World Business, Spring 1978.
- 20 See Louis T. Wells, Jr. forthcoming book from The MIT Press, referred to on p. iii.