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TRANSNATIONAL CORPORATIONS AND TECHNOLOGICAL DEVELOPMENT *

by

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1. There is growing awareness in developing countries of the critical role of technology in the process of industrialization. The earlier emphasis on investment flows, usually through TNCs from industrialized economies, is increasingly being replaced by the realization that technology flows and domestic technological development are of equal, if not greater significance. At the same time, it is also being recognised that the present pattern of foreign technology flows and the continued dependence on such flows is not consistent with basic developmental objectives and that an essential policy objective must be to achieve increased technological self-reliance. The concept of technological self-reliance does not deny the importance of foreign technology, rather, it seeks to place it in its proper perspective. Self-reliance thus is conceived in terms of the capacity to identify national technological needs and the selection and application of both foreign and domestic technology under conditions which enhance the growth of national technological capability leading to self-sustained technological development.

2. Planning for technological development cannot be done in a vacuum, but needs to be evolved within the framework of an overall development plan for any economy. A development plan should identify not only broad socio-economic objectives such as increased employment, incomes, regional dispersal and the like, but also determine sectoral priorities and targets sought to be achieved in particular branches of industry within the planning period. Once such development objectives and targets are identified, the determination of technological needs and assessment of alternatives can be undertaken in a proper perspective. Technological progress can undoubtedly take place even without detailed sectoral planning as has occurred in countries such as Korea,

Mexico, and Thailand, but such development tends to be unbalanced and isolated contributing only unevenly to an overall pattern of technological development. If technology planning is to be really effective and comprehensive, it must follow from a broader plan and programme for economic and industrial development.

Objectives of technology policy

3. Rapid growth of technological capability and self-reliance can only be achieved within the framework of a well-defined policy and programme for technological development, oriented to the needs of each economy. Such a policy becomes necessary because the existing pattern of technology use and application have resulted in the perpetuation of dependence on foreign technology and services in most developing countries, except where deliberate policy measures have been adopted in this regard. With increased trade in technology through licencing and management and service contracts, apart from direct foreign investment (DFI), foreign technology and knowhow is emerging as a major factor in industrial relationships between TNCs and developing country enterprises. While developing countries must avail of foreign technology and participate increasingly in international trade in technology, national policies should ensure that such participation is consistent with domestic technological development.

4. Despite the critical importance of this factor, few developing countries have so far adopted a comprehensive plan for technological development. Where technology policies and measures have been undertaken, these have been largely confined to regulating or screening the terms and conditions of

foreign technology acquisition. This by itself would not be enough. Technology policy must cover the selection and choice of technology appropriate to domestic factor resources on the one hand and to national development on the other. It must also ensure the rapid growth of domestic technology and adaptations and innovations are related to local conditions and structures. It should also achieve increased domestic capability in technological services including management, marketing and consultancy engineering know-how. Appropriation of these functions by the domestic economy would impinge directly on the role and activities of TNCs which traditionally have served as a major channel for technology flows to developing countries.

Role and operation of TNCs

5. The importance of TNCs in this context is derived from their capacity to operate in developing countries by combining investment, financial power and management expertise on the one hand and generation or acquisition of technological knowledge on the other. Whil in several sectors technology ownership is not confined to TNCs and various alternative sources are available, TNCs have been in a position to package various combinations of investment, technology and services in their respective sectors of specialization to a much greater extent than enterprises operating within national boundaries. Thus, increased commercialization of technology and closer technological linkages and interdependence among countries has largely accrued from a process of multinationalization, whereby TNCs have emerged as the principal agents of technology circulation on a global basis. Technological advantage has constituted a major factor in strengthening the competitive position and

and market power of TNCs, which is sustained by a centralized organizational structure, providing the benefits of economies of scale in particular production operations. The global strategy and the international division of labour among the affiliates pursued by the TNC inevitably influence the nature of the transferred technology, the method of transfer, and the terms and conditions attached to the usage of technology by the affiliated enterprises.

6. Historically, commercialization of technology has taken place predominantly within the DFI process of TNCs in host developing countries where they have enjoyed considerable competitive advantage over domestic companies. Estimates of the profitability from foreign operation included not only the returns from the technology itself but revenues from other elements of the DFI package which are tied to the commercialization of the technology. Thus, market entry, particularly through wholly-owned subsidiaries, secured the benefits derived from the whole investment package, such as revenues from equity capital, management services and commercialization of mature technologies which frequently had already been diffused and might even be non-proprietary to the company. DFI consequently enabled also the commercialization of those elements, for example, technology or services which otherwise may have had lower market value.

Pattern of ownership and technology receipts

7. The preference for establishing whole or majority ownership in the host country has been particularly dominant in the case of United States TNCs. Between 1951 - 1974 at the time of entry, over 70 percent of the affiliates established by 180 United States TNCs in developing countries where wholly

or majority owned.[1/] This high prevalance of the whole and majority ownership of United States corporations is reflected in the share of technology receipts obtained from their affiliates. In 1977, for example, 79.7 percent of the technology receipts of United States TNCs came from their affiliates. Above-average shares were received from LDCs: 82 from Latin America and 86 percent from Asian and African countries. (This marks a decreasing trend from the previous high of 89 percent and 92 percent, respectively, in 1971).[2/]

3. Ownership pattern of non-United States based TNCs shows higher prevalence of minority joint ventures; whole or majority ownership of affiliates established in LDCs until 1970 took place only in the case of 44 percent of the entries.[3/] Similarly, in the case of United Kingdom and Federal Republic of Germany TNCs, the receipts from intra-firm technology payments show lower levels than for United States companies. Thus, in 1975 the share of intra-firm technology receipts of United Kingdom TNCs constituted only 30.2 percent of the total receipts.

9. However, for an accurate assessment of the share of intra-firm technology flows, the following limitations of the British data have to be considered:

-- The survey is based on an incomplete response from the 1,200 companies contacted. It is estimated that the returns comrpise only 70 percent of the

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1/ See Appendix 1, Ownership pattern of US based affiliates in developing countries, 1951 - 1974.

2/ See Appendix 2, Percentage share of affiliates from the total receipts of fees and royalties of US corporations by geographic areas.

3/ See Appendix 3, Ownership pattern of non-United States based affiliates in developing countries, 1970.

technology receipts; the distribution of the remaining 30 percent is unknown.

-- Receipts from oil companies are excluded.

-- Technology payments are excluded where charges for technology payments are incorporated in the contract price of capital goods. According to the Board of Trade, this omission is most important in respect to large contracts such as erection of complete plants, where the transfer of technology is an integral part of the contract and receipts from the entire contracts are recorded in the export statistics.

-- In the case of companies in the United Kingdom, frequently technology payments of the affiliates are not charged explicitly by the parent company but are part of the total earning of the parent company. This practice has been more prevalent in the case of United Kingdom TNCs than for United States companies.[1/]

10. Because of the definitional differences used in the Federal Republic of Germany, the share of receipts for intra-firm transactions shown by the data is not comparable to the United States or United Kingdom data.[2/] Magnitude of intra-firm transactions is reflected more in the share of intra-firm payments which reached 60.6 percent in 1975.

1/ "Overseas Royalties and Similar Transactions in 1975," Trade and Industry, 12 April 1977, p. 293; and W.B. Reddaway, S.J. Potter and C.T. Taylor, Effects of UK Direct Investment Overseas, Cambridge University Press, 1968.

2/ Technology receipts "do not give a complete picture because not every transfer of technological know-how is connected with corresponding flows of money. In many instances enterprises exchange technological know-how without statistically recordable payments or accounting involved...Sometimes various company members interested in the results share in the research costs. Payments for such future know-how are made as contributions to costs and not as licence payments." "Patents and licence transactions with foreign countries," Monthly Report of the Deutsche Bank, Vol.28, No. 4, April 1976, Frankfurt am Main.

11. Available host country statistics record lower shares of intra-firm technology transactions with all TNCs, indicating that technology contracts with non-United States TNCs take place less frequently within equity-relationship compared with United States TNCs. In 1972, the share of intra-firm technology payments in Argentina was 41 percent; in 1965 in Brazil, it was 58 percent which increased to 72 percent by 1970; and in 1974 in Peru, it was 54 percent. The highest share of intra-firm payments was recorded by Mexico: 78.9 percent in 1971. In 1972 in Thailand, over 60 percert and in 1970 in the Philippines, over 50 percent of the payments were affected between the affiliate and the parent company.[1/]

12. The aggregate share of intra-firm transactions varies not only by home and host countries, but substantial differences exist across industrial sectors. The range of variation is demonstrated, for example in case of Brazil where in a number of sectors - automobile, transformers, tobacco, electric motors - close to 100 percent of the technology payments were affected between the affiliate and the parent company.[2/] In the more "traditional" sectors, such as wood, paper, leather where technologies are more widely diffused or available from the manufacturer of the machinery, technology payments between independent domestic companies and TNCs predominate.

13. While the analysis of the sectoral distribution of the share of intra-firm technology payments is hindered by the paucity of information published by LDCs, the degree of foreign ownership within a given sector indicates the importance

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1/ D. Chudnovsky, et. al., Aspectos económicos de la importación de tecnología en la Argentina en 1972, INTI, Buenos Aires, 1974; A.F. Biato, E.A.A. Guimaraes and M.H. Poppe de Figueredo, A Transferencia de Tecnologia no Brasil, IPEA, Brasilia, 1973; ITINTEC, Efecto del proceso de importación de tecnología en el Perú, 1971-1974, Lima, 1976; F. Fajnzylber and M. Tarrago, Las empresas transnacionales, CIDE/CONACYT, Mexico, 1975; UNIDO, Development and Transfer of Technology Series, No.1, New York, 1977.

2/ Appendix 6, 'Share of intra-firm technology payments in electrical industries," Brazil, 1965-1970.

of transfer of technology through TNC equity participation. Analysis of the share of foreign penetration in the different sectors of the manufacturing industry in several developing countries shows that foreign ownership and thus transfer of technology by equity participation has been predominant in the research-intensive, oligopolistic sectors such as pharmaceuticals, petrochemicals, electronics and transportation equipment.[1/] At the same time, the data shows that within these industries substantial country-by-country variations exist, which reflect the different host government regulation towards DFI and its foreign technology acquisition policy, and the capability of the domestic economy to absorb foreign technology without foreign participation. Furthermore, differences are also attributable to the different attractiveness of a given home country for the TNCs and thus its willingness to commercialize technology depackaged from DFI.

Emerging trends

14. While the TNCs' preference for establishing wholly-owned subsidiaries and tight control over the technology within the corporate system is generally recognized, their willingness to engage in joint ventures and sale or licensing of technology without equity involvement has become increasingly prevalent in a large number of sectors. Regulatory measures of developing countries to limit the foreign share of equity has been possible in sectors where alternative sources of technology are available which strengthened the bargaining position of the host country. In other instances, the domestic economy's technological capability was strong enough to absorb the foreign technology within the contract period. The scope of acquisition of technology through licensing and service agreements at an

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1/ See Appendix 7.

enterprise-to-enterprise level becomes greater with increasing entrepreneurial and technological capacity in a host country. Thus, licensing without foreign equity participation requires an adequate technological base on the part of the domestic recipient enterprise which enables adequate absorption of foreign technology. Similarly, in sectors where a slow pace of technological change allowed the standardization and diffusion of technology, alternative contractual arrangements to foreign equity participation becomes increasingly possible. Consequently, there is a growing trend towards non-equity or minority foreign ownership arrangements in several countries where the domestic entrepreneurial and technological infra-structure in particular sectors have developed adequately.

15. The market power of TNCs, however, continues to be a dominant factor in determining the availability and pattern of technology transfer in advanced science-based sectors where technology ownership is largely concentrated in a few large TNCs. In these sectors, due to increasing R and D costs, the economies of scale involved in technological innovation and commercialization and high costs of market failure, large companies have become the major source of technological development and consequently, owners of improved and new technology. Similarly, in sectors where fast technological change reduces the product life cycle, for example, in the case of drugs, scientific instruments and electronics, significance of technological advantage in the competitive position of the firm renders retention of control over the technology within the corporate system the major motivating factor in the commercialization of technology. In these sectors, transfer of technological know-how remains confined largely to wholly or majority-owned subsidiaries. Where

foreign minority ownership is unavoidable, effective control over technology use is sought to be achieved through management or service contracts. Diffusion of technology in these advanced sectors and entry by competitive firms is limited frequently on the one hand, by a large degree of cross-licensing, patent pooling and other forms of technology sharing arrangements among the leading TNCs and by intra-firm technology flow on the other hand. These barriers to entry resulting from the concentration of technology ownership among the industry leaders have been particularly prevalent, for example in the chemical industry and in the manufacturing of heavy electrical and telecommunication equipment. In these sectors, the fact of effective control over proprietary technology by a limited number of TNCs and their oligopolistic power enables to subject the form of entry and conditions of transfer to the global strategy of TNC.

16. Despite the regulatory measures instituted by several LDCs and the increased availability of technological alternatives in certain sectors, the role of TNC subsidiaries and affiliates in most developing countries assume special significance because of their dominant position in several branches of industry for historical reasons.[1/] In most countries of Africa and Latin America, mineral industries remained largely under foreign ownership or control even though greater domestic participation, often through state

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1/ Share of foreign ownership in LDCs in the manufacturing industry and in selected sectors are shown in Appendix 7.

enterprises, has been increasing in recent years. State participation and control have been most marked in the petroleum industry, but both in petroleum and other resource-based industries, TNCs have continued to exercise significant control through supply of technology and services. In several developing countries, even relatively low-technology, consumer goods production has remained under the control of foreign subsidiaries. In the case of middle-technology and high-technology industrial sectors, TNC subsidiaries and affiliates exert dominant influence even in countries, for example, Brazil, India, Korea where significant domestic entrepreneurial capability is available. In several service sectors, including merchandising, TNC subsidiaries and affiliates continue to play a decisive role in many developing countries. In the formulation of national technological policy in these countries, it is essential therefore to ensure that the technological impact of TNC operations, both in respect of existing subsidiaries and affiliates and future arrangments with TNCs, are evaluated and taken into account.

Impact on technological development

17. The role of TNCs in terms of their impact on domestic technological development and capability in various branches of manufacturing and services is being seriously questioned in several countries. The concept of international division of labour and consequential uneven development of technological capability is itself inconsistent with national development objectives and priorities of many LDC countries. With growing policy emphasis on key areas such as greater downstream processing in resource-based industries, production of basic industrial materials and machinery and equipment, establishment of linkage and feeder industries in various sectors, increased domestic

integration and value-added as against assembly operations, the technological needs of most developing countries would be substantially different from the existing pattern of technology flows through TNCs. The selection of products and the manufacture of differentiated goods by TNCs, supported by trademarks and brand names, are often viewed as having an adverse socio-cultural impact including the creation of consumer needs which emulate consumption patterns in developed countries and are geared to the needs of higher income consumer segments in these countries. There is also greater awareness that the type of technology imported by TNCs is often not suitable for developing countries, as these tend to replicate the operations of parent TNCs and reflect the needs, market conditions and techno-economic endowments of industrialized economies. When applied in certain developing countries, they may necessitate the maintenance of a high input proportion or high degrees of absorptive and operational skills which requires a long learning period. Similarly, the appropriateness of highly capital-intensive technology in sectors where available technological alternatives would be more consistent with factor endowments and development objectives are increasingly questioned. The fact that R and D activities in the case of TNCs are almost wholly conducted in developed countries is also increasingly being recognised as severely restricting the growth of innovative and adaptive capability in developing countries.[1/] The high costs of foreign technology and the restrictive and limiting conditions under which they are made available to developing country enterprises, including TNC subsidiaries

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1/ R and D expenditures of United States TNCs spent abroad are given in Appendix 11.

and affiliates is also an issue receiving increasing attention in several developing countries.

Patenting strategy

18. An important aspect of TNCs control over diffusion of technology stems from their patenting strategy which secures proprietary rights on a world-wide basis. While the extent of patenting by major TNCs has been declining in certain sectors, for example in pharmaceuticals, where a high rate of competitive imitation limits willingness to patents. Patenting acts in many sectors as a significant hindering element in technology diffusion process in developing countries.

19. Under the present international patent system, adopted by the majority of LDCs, the foreign patent holder is granted the same legal protection as the domestic innovator. In addition, patenting confers the TNCs the exclusive right to export if the market size does not justify local production. This protection awarded to the patent holder resulted in excessively high levels of patent registration in LDCs with actual utilization rates often falling below 1 percent of the registered patents. In Colombia, for example, from the 3,513 patents registered in the late 1960s in the chemical industry, only ten were used in industrial production.[1/] Similarly, in 1975 in Peru, the patent utilization rate was below .5.[2/]

1/ C.V. Vaitsos, "Patents Revisited: Their Function in Developing Countries," Journal of Development Studies, Vol. 9, No. 1, October 1972.

2/ M.A. Zevallos y Muniz, Análisis estadístico de las patentes en el Perú, Consejo Nacional de Investigación, Lima, 1976.

20. The extensive patenting activity of TNCs has had a strong supressing effect on local innovative activity and contributed to a continuous decline in the share of locally owned patents. This trend is demonstrated in the example of Chile, shown in Appendix 8, which was characteristic for most developing countries throughout the past decades. The insignificantly low share and economic importance of locally held patents tend to demonstrate that the present patent system has hampered the development of local innovative activity. Recent patent legislations adopted by some developing countries have aimed to reduce the negative impact of the patenting strategy of TNCs. The new patent law of Mexico (1976) aims to reduce the time span of patent validity and thus increase the diffusion of the technology within the economy. Simarly, the Brazilian patent law which prohibits the patentability in sectors which are deemed to be vital for national development such as food processing, aims to limit the monopoly power based on the ownership of proprietary technology in certain sectors. Increase in market competitivenes is envisaged by the new Mexican law which imposes compulsory licensing requirement in case of non-utilization of the patent within two years of its registration.

TNCs and domestic R and D

21. As proprietary and non-proprietary knowledge is transferred by a TNC partly in embodied and disembodied form from the parent company, there is little interest or initiative for R and D activities by subsidiaries and affiliates. Since affiliates obtain only those elements which have already been commercialized in the home market, the R and D function has been completed for the specific technology at the parent company. New technologies, including improvements, are developed in the parent company, which is close to the

initial commercialization of the technology and has an advanced scientific and technological infrastructure. Centralization of technology generation at the parent company also helps to ensure the control over proprietary technology. Local R and D activity in developing countries is confined to local product adaptation testing of products which are not available in developed countries, such as certain drugs, or in case of products which are only locally produced such as tea processing.[1/] The absence of R and D in the host country renders the affiliate dependent on the parent company for the continuous flow of technological improvements which becomes a major element of control. Technology ownership can be similarly the controlling element in the case of joint ventures, particularly when technology transfer includes patented know-how brands or trademark names.

22. The lack of R and D activity by TNC affiliates has significant repercussions on the development of national scientific and technological capacity in the host country. The low demand for scientific and research personnel hinders the development of indigenous engineering and design capabilities necessary for the effective absorption of foreign technology and indigeneous technology creation. Also in the absence of local R and D, the affiliate has little technological linkage with local scientific and research institutions, which would promote technological research capability and promote diffusion within the economy.

1/ OECD, Development Centre Studies, "Transfer of Technology by Multinational Corporations", Vol. 1 (ed.), D. Germidis, Paris, 1977; C. de Faro Passos, "Multinational corporations and transfer of technology: The case of Brazil" and R. Kaplinsky and S. Chishti, "Multinational corporations and transfer of technology: Some British multinationsl in Kenya and India", in OECD Development Centre Studies, ibid.

23. The increased alternatives open for domestic companies to acquire foreign technology through licensing can have far-reaching implications on domestic R and D activities in various production and service sectors. Given the initial low national scientific and technological capacity of most developing countries, the large and long-term commitments needed in R and D activity and the risks involved in innovation, the acquisition of foreign technology with a predictable performance has more economic justification for domestic companies than technology generation by internal R and D. Furthermore, marketing risks can be substantially reduced if the domestic company acquires rights to use foreign brand names and trademarks which enjoy high market acceptance. Usually, foreign trademark and brand usage requires the application of foreign technology, quality control and technical assistance which reduces the need for R and D to be performed by the domestic licencee. Consequently, in developing countries where private corporations have the freedom to select suppliers for their technological needs, there is a general preference towards acquiring foreign technology even though similar alternatives might be available from local companies. This bias towards foreign technology acquisition by domestic companies can only be counterbalanced by the pursuit of a conscious government technology policy aiming at greater utilization of domestic technology, where these are competitive or more appropriate in the context of overall development objectives.

Cost of foreign technology

24. Cost of foreign technology for developing countries are difficult to estimate on an aggregate level. Technology payments as indicated in the balance of payments of selected LDCs are shown in Appendix 10. This comprises, however, only the

direct costs accruing from royalty and fee payments which might be only a small part of the associated indirect costs resulting from the restrictions imposed on the foreign technology users. Furthermore, in many developing countries, transfer of technology takes place predominantly by intra-firm technology transactions where the parent company might not charge a separate price for the wholly-owned affiliate, or might charge lower price than in case of a joint venture when revenues from technology are included in the total return of the company. Similarly, initial engineering and design costs which are not of a recurring nature are not included in the technology payment balance but may constitute part of the trade balance.

25. Several studies have sought to compare the costs of foreign technology according to the method of acquisition, usually contrasting acquisition with TNC equity ownership and licensing by independent domestic companies.[1/] Because of the different nature of the DFI and the technology package, however, neither costs nor benefits are directly comparable. Also evaluation of the two alternatives seldom arises as the technology acquisition in form of TNC equity participation is generally based on a decision when technology decomposed from the DFI package is not available for the host country or when the locally available skill levels are not sufficient to absorb the foreign technology without a long-term commitment on the part of the foreign technology seller.

1/ For example, a recent study was prepared by D. Chudnovsky, "Pricing of intra-firm technological transactions," for a conference on transfer pricing at the Institute of Development Studies, University of Sussex, March 1978.

26. It is increasingly being recognized that DFI may be a relatively costly method to obtain foreign financial capital. At the same time, financial investment may serve as a vehicle to obtain technical management or marketing know-how or access to export markets, which may not be accessible without equity ownership.[1/] If access to certain essential technology is only feasible as part of an investment package, the foreign affiliate may be tied to the parent company in a number of ways which gives rise to different financial flows which may be difficult to determine in precise terms. The parent company is interested in the total returns from the affiliate, and the breakdown of the payments will be determined from financial management considerations and home and host country regulations (e.g. tax laws, foreign exchange regulation, maximum royalties, etc.). Consequently, payments accruing to equity generally contain substantial parts which reflect returns to these other inputs as well as the oligopoly situation they create.

27. Indirect costs of foreign technology arise from the restrictions imposed by the TNC on the user of the licensed technology. Restrictions aim to retain control over the operations of the licensee and thus increase the return from the commercialization of the technology. This takes place partly by tying management and supply requirements, such as intermediate and capital goods which effectively limit the depackaging of the technology by the user and renders monopolistic benefits by way of overpricing the tied inputs. Similarly,

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1/ C. Vaitsos, Money as a negotiable input in international business activities, paper presented at the United Nations Centre on Transnational Corporations Round Table on Negotiations with Transnational Corporations, Seven Springs, April 1978.

export restrictions imposed on the technology user aim to protect the other markets of the TNC's global operation from possible competition from the licensee. The prevalence of restrictive clauses, which today are well documented for technology contracts entered into during the 1950s and 1960s, have shown that overpricing of tied inputs, management contracts, and production and export restrictions might be a multiple of direct costs.[1/]

28. It is against the above background of TNC operations in technology transfer that certain policy trends in host developing countries should be considered. The present trend is to move away from wholly-owned foreign subsidiaries, and the screening of foreign investment proposals in most developing countries aimes at greater domestic participation in ownership and control. Foreign subsidiaries are still encouraged or accepted in situations where alternative sources of capital investment may not be available as in the case of mineral and resource based industries in some countries, or in ~~light~~ technology sectors where technology would not otherwise be available, for example, in electronics or drugs and pharmaceuticals or in primarily export-oriented enterprises. In most other fields, the policy trend is to encourage joint ventures, with different degrees of foreign participation, including gradual divestment of foreign holdings within a certain time frame. The well-defined policy towards DFI has an important bearing on the technological development of a particular sector and the policy instruments that have to be utilized to ensure greater domestic technological growth.

1/ A recent comprehensive review of the literature on transfer pricing practices of transnational corporations is presented in the UNCTAD Study, Dominant Positions of Market Power of Transnational Corporations: Use of the Transfer Pricing Mechanisms, (UNCTAD/ST/MD/6), July 1977.

Technology policy has to be framed so as to deal with various situations of foreign ownership and control, and must be viewed as an integral part of an overall policy towards direct foreign investment and the role ascribed to DFI in various sectors of the economy.

Technology policy and TNCs

29. In view of the dominant and continuing role of TNCs as one of the major channels for technology transfer to developing countries, technology planning and policies must be directly related to the operation of TNCs and their impact in the host country. The nature of technology flow and its repercussions on the technological capability of developing countries, as discussed above, emphasise the need for an overall reappraisal and review of the technology acquisition process through TNCs, and the role of specific country institutions, as an essential aspect of technology planning.

30. There can be little doubt that a very substantial increase in the flow of technology to developing countries must take place if an adequate pace of industrial growth is to be achieved. Since in a large number of manufacturing and service sectors TNCs retain oligopolistic control over technology, a considerable proportion of technology acquisition may need to take place through their operation. In view, however, of the characteristic of technology strategy implemented by TNCs host country, technology plans and policies will need to channel the operation of TNCs according to national objectives and priorities.

31. It has been mentioned earlier that identification of technological needs in terms of developmental and sectoral priorities constitutes an initial aspect of technology planning. Once such needs are assessed from a long-term

perspective and in terms of short-period development plans, the specific role and the possible pattern of corporate relationships with TNCs in various sectors of the economy can be established. In certain branches, particularly high-technology industries, it may be necessary to utilize TNCs, both as sources of investment and as suppliers of proprietory technology. In sectors where the domestic industry has the necessary entrepreneurial capability and technological base, technological needs may be served by licensing and other contractual arrangements without foreign capital participation. In certain fields, it may not be desirable to encourage foreign technology flows in order to utilize and enhance domestic innovative capability. This approach would be relevant in sectors where appropriate domestic technology is available or where foreign technology has been adequately absorbed by domestic industrial enterprises.

32. Within the context of sectoral technological needs, the choice of technology becomes an essential consideration. As discussed earlier, technology available from TNCs is generally firm-specific or specific in terms of particular differentiated goods produced by a parent TNC or its affiliates. Thus, in the selection and evaluation of products and technology adequate knowledge of alternatives is a major precondition. The need for a technological information system in developing countries reflects the significance of information on technological alternatives. Knowledge of alternatives and the capability to evaluate and compare alternatives may be critical for determing the 'appropriateness' and suitability of particular technologies in different country situations.

33. The role and functions to be exercised by institutional agencies constitute an important aspect of technology planning. The scope of their operation can be extended to various levels of intervention, ranging from screening of the technology for its suitability and necessity for the domestic economy including the terms and conditions of technology utilization. In most cases, institutions dealing with information on technological alternatives may provide useful assistance in evaluation process with the ultimate choice being exercised by the enterprise concerned. The selection and evaluation of alternatives can have considerable impact on the nature of technology acquired from TNCs and the modifications and adjustments that may need to be made before these are applied.

34. The technological requirements of linkage industries also constitute an important element of negotiations with TNCs. In the case of mineral industries, for example, technology for downstream processing stages would be a significant aspect to be considered and host country and TNC interests would need to be harmonized. Similarly, the extent and nature of domestic integration and the increase in value-added over a defined period need to be established in the course of negotiations. The development of domestic marketing and managerial expertise, besides operational skills, should also be identified as being an important responsibility of TNCs in various sectors.

35. An important aspect of negotiations with TNCs relates to the disaggregation or unbundling of the technology package. TNCs tend to aggregate the investment function with the various technology elements including project engineering, production technology, management and marketing. From the host

developing country's viewpoint, it is important that the package should be unbundled and evaluated in terms of its various components. The unbundling of the technology package is important for determining the cost element of each part in the package, but of even greater significance is the possibility of domestic industry to participate in the supply of inputs and project engineering services. Even if the cost of domestic goods and services tends to be above world market prices in earlier stages of industrialization, this may nevertheless be justified in the long-term interests of development of domestic capabilities. The extent of unbundling may, however, be limited in certain sectors where TNCs can ensure that the technology is used only by a subsidiary or affiliate under its control or is sold only in the form of a complete system, and not as separate components. Similarly, where foreign engineering contractors with the skills to combine various inputs are themselves dependent on the technology supplier, the incentive to "unbundle" may be weak or lacking. In such cases, a great deal may depend on the technical and managerial expertise and contracting skills available in the host country. Some countries have, accordingly, placed great emphasis on the development of domestic capabilities in consultant services.

36. The terms and conditions of technology contracts with TNCs have received considerable attention in many developing countries. Legislative measures have been introduced in some countries against the imposition of restrictive business practices, including 'tie-in' provisions for supply of imported parts, and various restrictions concerning production and sales territory. The period of agreement is also sought to be limited as well as the continued use of the

technology after the contract period ensured. Regulatory institutions in several countries have adopted guidelines which are fairly similar in scope. At the international level, a Code of Conduct in respect of technology transfer is under inter-governmental negotiations in UNCTAD.

37. The response of TNCs to technology regulation has tended to vary from country to country, depending primarily on the bargaining capacity of the country emanating largely from the market size and endowments. Thus, in Brazil and Mexico, regulation does not seem to have resulted in any significant reduction of technology flow through TNCs. In countries with smaller domestic markets, the impact of regulation may well be different and policy guidelines have to take this factor into account.

38. It is important that the impact of operations of TNC subsidiaries and affiliates on domestic technological development is monitored on a continuous basis. This review process follows the path of technological development the R and D undertaken by the foreign affiliate and the adaptations performed to suit local conditions and requirements. This review should cover existing subsidiaries and affiliates and also new enterprises involving TNC's participation.

39. Given the realities that foreign technology will continue to flow to developing countries through the channel of TNCs, subject to their global interests and operations in various sectors, it is necessary for host countries to establish comprehensive policy measures, supported by institutional mechanisms, which enhances the development of technological capacity. Policy measures should cover the overall policy in respect of DFI including sectors reserved for State

enterprises and wholly national-owned enterprises, and policies in respect of foreign capital ownership in different sectors. The exercise of selectivity in this regard through a process of regulation and screening would have a direct bearing on technology flows through TNCs and should result in a greater flow of technology and know-how through other arrangements such as licensing and service contracts. The regulation and screening of technology and service contracts should be a logical follow-up of regulation of DFI. This should included the identification of sectors and branches in which foreign technology should not be encouraged or where it should only be permitted to the extent that it supplements domestic technological capability. Measures for 'unbundling' of technology should enable maximum use of domestic inputs, particularly technological services, including project engineering, management and marketing know-how. Policy guidelines can also be prescribed concerning restrictions in use of foreign personnel, training programmes for domestic personnel at various levels, and enterprise-level of R and D. Import restrictions and controls can significanly affect greater technology flow for linkage industries and adaptive use of local materials and parts. Export incentives and insistence on export commitments by TNC subsidiaries can, on the other hand, improve the balance of payments performance of TNCs and achieve better quality production. Implementation of a comprehensive policy system can be a major contributing factor in programming for domestic technological development.

40. It is equally important that institutional facilities are established and developed to bring about greater domestic capability in various sectors. Governmental agencies to screen foreign investment and foreign technology

proposals already exist in several countries. Their role and functions in respect of domestic technological development may, however, need to be more comprehensively defined. At the same time, institutional assistance to domestic industry is necessary in respect of technological information, including on alternatives and on different forms and conditions of technology of service contracts. Similar institutional guidance and support is essential for assessing the impact of foreign technology in various sectors and in linkage industries. Domestic R and D institutions dealing with industrial technology have also to establish closer links with industrial enterprises, including TNC subsidiaries and affiliates. One of the basic functions of such institutions should also be to provide the institutional framework within which negotiations with TNCs are conducted and projects with TNC involvement are implemented. A comprehensive programme for domestic technological development must extend considerably beyond the harmonization of host country policies and objectives to that of TNC subsidiaries and affiliates. At the same time, such harmonization must be viewed as an essential feature of technology planning designed to achieve greater domestic technology capability in developing countries.

Appendix 1

Ownership pattern at time of entry of affiliates in developing countries of 180 United States-based transnational corporations, 1951-1975

Year	Wholly owned (95 - 100 per cent)	Majority-owned (51 - 94 per cent)	Co-owned (50 per cent)	Minority-owned (10 - 49 per cent)	Unknown	Total number
	(Percentage)					
1951-1966	60.4	12.9	6.6	12.3	7.8	2 364
1967-69	65.7	13.2	7.6	10.4	3.1	930
1970-72	68.5	12.0	6.8	12.0	0.7	724
1973-75	63.8	9.8	2.9	19.4	4.1	614

Source: Joan Curhan, William Davidson, Rajan Suri, Tracing the Multinationals, Ballinger Publishing Co., Cambridge, Mass. 1977.

Appendix 2

Percentage share of affiliates from the total receipts of fees and royalties a/ of United States corporations, by geographical area, 1965-1977

Year	Total	European Economic Community (6)	Japan	Latin American republics and other Western hemisphere	Other countries in Asia and Africa b/
1965	n.a.	n.a.	24.5	n.a.	n.a.
1971	78.1	76.7	31.4	88.2	92.0
1977	79.7	80.1	50.9	81.8	85.8

Source: United States Department of Commerce, Survey of Current Business, various issues.

a/ Includes film rentals. Methodology is explained in Survey of Current Business, December 1973, p. 15.

b/ Includes all countries of Asia except Australia and New Zealand and all of Africa except South Africa.

Appendix

Ownership pattern of manufacturing subsidiaries of 211 non-United States transnational corporations in developing countries, 1970

Type of ownership	Number of subsidiaries	Percentage share from total number of subsidiaries
Total number of subsidiaries	1,895	100.0
of which:		
Wholly-owned a/	392	20.7
Majority-owned	428	22.6
Co-owned	298	15.7
Minority-owned	441	23.3
Unknown	336	17.7

Source: Computation based on Transnational Corporations in World Development: A Re-examination, United Nations, 1978, Table C.13.

a/ Subsidiaries of which the parent firm of the system owns 95 per cent or more are classified as wholly-owned; over 50 per cent, as majority-owned; exactly 50 per cent as co-owned; 5 to less than 50 per cent as minority-owned.

Appendix 4

Estimated[a] overseas royalties and fees,[b] United Kingdom, 1965-1975

(Millions of pounds sterling)

	1965	1970	1975
Total receipts	64.8	142.1	274.4
Total payments	55.7	118.1	238.3
Balance	+9.1	+24.0	+36.1
Percentage share of receipts with affiliates	33.6	31.2	31.6
Percentage share of payments with affiliates	53.1	57.1	63.3

Source: Trade and Industry, 12 August 1977, p. 293.

*For the method of estimation, see page 3.

**All industries, including film, excluding oil companies.

Appendix 5

Royalties and fees of the Federal Republic of Germany, 1971, 1975

(Millions of US dollars)

	Affiliate firms				Unaffiliate firms		Total	
	1971		1975		1971	1975	1971	1975
	Value	Percentage of total	Value	Percentage of total				
Receipts	7.2	4.6	16.7	5.2	129.2	291.4	136.4	308.1
Payments	-209.1	49.2	-562.1	67.4	-90.5	-166.6	-424.8	834.0
Balance	-201.9		-545.4		+38.7	+124.8	-268.4	-510.5

Source: Monthly Report of the Deutsche Bundesbank, 1973, 1976

Appendix 6

Share of intra-firm technology payments in selected industries, Brazil, 1965-1970

Industrial sector	Percentage share of intra-firm payments from total technology payments
Glass	57
Cement	52
Non-metallic products	54
Metalworking machinery	93
Textile machinery	83
Electrical motors	97
Transformers	100
Household electrical products	82
Transportation equipment	100
Wood	-
Furniture	-
Paper	45
Rubber	100
Leather and furs	94
Inorganic chemicals (including fertilizers)	65

Source: F. Alveida Biato, E.A.A. Guimaraes and M.H. Peppe de Figueiredo, A Transferencia de Tecnologia no Brasil, IPEA, Brasilia, 1973.

Appendix 7.1

Estimated shares of manufacturing held by foreign enterprises, selected countries and territories, latest available year

Country or territory	Percentage foreign share of: Sales	Employment	Assets	Value added	Year	Criterion of foreign ownership (Percentage)
Nigeria	...	...	70 a/	...	1963	...
Canada	56	32	...	...	1973	50 and more
Malaysia	...	...	50 b/	...	1971	...
China	50 c/	...	...	...	1974	...
Brazil	49 d/	...	29 e/	37 e/	1974	...
Peru	46	...	...	...	1969	...
Australia	36	29	42	34	1972/73	25 and more
Turkey	...	...	41	...	1974	10 and more
South Africa	...	...	40 e/	...	1972	...
Belgium	33	18	...	...	1968	...
New Zealand	33	...	...	...	1969/70	...
Central American Common Market	31	...	...	...	1971	...
Argentina	31	...	...	...	1972	...
Singapore	...	30	...	...	1968	...
Mexico	27	...	...	23	1972	...
France	27	19	...	...	1973	20 and more
Germany, Federal Republic of	25	22	...	23	1972	...
Austria	23	23	20	...	1973	50 and more
Norway	19	12	11	18	1974	...
United Kingdom	14	10	16	13	1971	...
India	13	...	...	...	1973	50 and more
Denmark	11 f/	...	...	...	1971	...
Korea, Republic of	11	...	...	...	1974	...
Spain	11	...	...	...	1971	50 and more
Hong Kong	...	11	...	...	1971	...
Sweden	10	...	8	...	1974	20 and more
Thailand	...	9	...	...	1970	...
Finland	5	4	...	...	1972	20 and more
Japan	4	2	...	...	1972	20 and more
United States	4	3	...	...	1974	10 and more

(Source and foot-notes on following page)

Source: United Nations Centre on Transnational Corporations, based on: United Nations, Department of Economic and Social Affairs, Yearbook of Industrial Statistics, 1975 (United Nations publication, Sales No. E.77.XXVII.7); Organisation for Economic Co-operation and Development, Pénétration des entreprises multinationales dans l'industrie manufacturière des pays membres (Paris, 1977); International Labour Organisation, The Impact of Transnational Enterprises on Employment in the Developing Countries, prepared by Y. Sabolo and R. Trajtenberg (Geneva, 1976); Business International, Investing, Licensing and Training Conditions Abroad (New York, various issues); Nigeria, Federal Office of Statistics, Industrial Survey of Nigeria, 1968 (Lagos, 1971); Statistics Canada, Canada's International Investment Position, 1971-1973 (Ottawa, 1977); "Quem é quem na economia brasileira", Visao, 31 August 1975; R. Newfarmer and W. Mueller, Multinational Corporations in Brazil and Mexico: Structural Sources of Economic and Non-economic Power (Washington, D.C., Government Printing Office, 1975); Instituto de Planificacion Nacional, Algunos aspectos de la articulación, concentración, y dependencia estructural en la industria manufacturera peruana (Lima, 1975); Australian Bureau of Statistics, Foreign Control in Manufacturing Industry, 1972-1973 (Canberra, 1976); T. G. Vras, "Research on foreign capital investment in Turkey" in Turkey, an Economic Survey, 1977 (Istanbul, Turkish Industrialists' and Business Association, 1977); New Zealand Department of Statistics, Supplement to March 1974 Monthly Abstract of Statistics (Wellington, 1976); "Algunos apuntes sobre el grado de participación de la inversión extranjera directa en el proceso de la integración centroamericana" in E. Lizano, ed. La integracion economica centroamericana, (Mexico, Fondo de Cultura Economica, 1975); International Labour Organisation, El impacto de las empresas transnacionales sobre el empleo y los ingresos: el caso de Argentina, prepared by J. Sourrouille (Geneva, 1976); Osterreichische Nationalbank, Ausländische Direktinvestitionen in Osterreich (Vienna, 1976); Republic of Korea, Economic Planning Board, Special Survey on Operations of Foreign Private Firms in Korea, 1974 (Seoul, 1976); United States Department of Commerce, Foreign Investment in the United States (Washington, D.C., 1976).

a/ Based on the 625 largest manufacturing enterprises.

b/ Based on all commercial enterprises. Foreign share of assets based on all limited companies was 62 per cent in 1971.

c/ Based on total industry.

d/ Based on the 1,000 largest enterprises.

e/ Based on the 5,113 largest non-financial enterprises.

f/ Excluding car assembly and oil refining.

Appendix 7.2

Estimated foreign-controlled shares of the pharmaceutical industry; selected countries, 1975 a/

(Percentage)

Country and country group	Share of sales (Percentage)
Saudi Arabia	100
Nigeria	97
Belgium	90
Colombia	90
Venezuela	88
Brazil	85
Canada	85
Australia	85
Indonesia	85
Mexico	82
Central American Common Market (1970)	80
India	75
Iran	75
Argentina	70
United Kingdom	60
Italy	60
South Africa	60
Finland (1971)	50
Sweden	50
France	45
Portugal (1970)	44 b/
Turkey (1974)	40
Norway (1971)	36
Germany, Federal Republic of	35
Switzerland (1971)	34
Greece	28
Egypt (1971)	19
United States	15
Japan	13

Source: United Nations Centre on Transnational Corporations, based on United Nations Conference on Trade and Development, Major Issues Arising from the Transfer of Technology to Developing Countries (United Nations publication, Sales No.E.75.II.D.2); Business International, Investing, Licensing and Trading Conditions Abroad (New York, 1976); S. Lall, "The International Pharmaceutical Industry in Less Developed Countries, with Special Reference to India", Oxford Bulletin of Economics and Statistics, August 1974, p.162; Business Latin America, various issues; L.M. Wortzel, "Technology transfer in the pharmaceutical industry" (New York, UNITAR, 1971); "The Mathi Committee on the Indian Drug industry", in Report of the Committee on Drugs and Pharmaceutical Industry (New Delhi, Ministry of Petroleum and Chemicals, 1975); A. Cilingiroglu, "Transfer of Technology for Pharmaceutical Chemicals" (Paris, Organization for Economic Co-operation and Development, 1974); J. Katz, Oligopoli, firmas nacionales y empresas multinacionales (Buenos Aires, Siglo Veintiuno, 1974); M. Mandousson, The Pharmaceutical Industry in Egypt, Ph.D. Thesis, University of London, 1974; United States Department of Commerce, Foreign Direct Investment in the United States (Washington, D.C., 1976); Japan Ministry of Foreign Trade and Industry, Trends in Foreign Capital Enterprises (Tokyo, 1971); L. Schaumann, Pharmaceutical Industry Dynamics and Outlook to 1985 (Menlo Park, Stanford Research Institute, 1976), table 3.

a/ Except where otherwise indicated.

b/ Refers to the market share held by the 15 largest foreign-owned companies out of the total 64 foreign-owned companies.

Appendix 7.3

Estimated foreign-controlled shares of selected industries in Brazil, Turkey and India, 1974

(Percentage)

Industry	Shares of: Assets		Output
	Brazil a/	Turkey	India b/
Manufacturing (total)	29	41	13
of which:			
Textiles	...	74	...
Food	31	58	...
Tobacco	99		...
Paper	...	56	...
Chemicals	...	...	33
Rubber	61	59	52
Electrical machinery	61	54	...
Non-electrical machinery	...	43	25
Transport equipment	68	...	10
Motor vehicles		38	
Ferrous and non-ferrous products	...	...	41
Metal goods	...	23	...
Non-metallic products	35	...	...
Mining	12	...	8

Source: "Quem é quem na economía brasileira", Visao, August 1975; T. G. Uras, "Research on foreign capital investment in Turkey", in Turkey, An Economic Survey, 1977, (Istanbul, Turkish Industrialists and Business Association, 1977); Reserve Bank of India, Bulletin, July 1975.

a/ Based on 5,113 non-financial enterprises.

b/ Data for 1973.

Appendix 7.4

. Indicators of foreign participation in selected industries in developed market economies and developing countries, selected years.

	Estimated percentage of foreign share of:						
ISIC No.	Chemicals (351-352)	Rubber (355)	Iron and steel basic industry (371)	Non-electrical machinery (382)	Electrical machinery (383)	Motor vehicles (3843)	Year
Argentina	37(0)	75(0)	...	82(0)	33(0)	84(0)	1969
Brazil	51(0)	44(0)	61(0) b/	55(A) b/	33(A) b/	100(A)	1976
India	27(0)	52(0)	41(0)	25(0)	33(0)	10(0)	1973
Korea, Republic of	22(E)	...	37(0)	19(0)	...	...	1970
Mexico	67(0)	84(0)	37(0)	31(0)	63(0)	...	1973
Peru	67(S)	88(S)	...	25(S)	62(S)	...	1969
Philippines	...	73(0)	...	...	...	43(A)	1973
Singapore	46(E)	76(E)	21(E)	...	...	...	1968

(Source and foot-notes on following page)

Source: United Nations Centre on Transnational Corporations, Transnational Corporations in World Development: A Reexamination, New York, 1978.

Appendix 7 5

Estimated foreign-controlled shares of selected Mexican industries, 1962-1970

(Percentage)

Industry	Estimated share of sales accounted for by foreign-controlled enterprises 1962	1970	Increase in share between 1962 and 1970 (Percentage points)
Manufacturing (total)	20	28	8
of which:			
Tobacco	65	80	15
Paper	22	27	5
Rubber	77	84	7
Chemicals	58	67	9
Non-metallic mineral products	24	27	3
Primary metals	18	25	7
Fabricated metals	21	37	16
Non-electrical machinery	45	62	17
Electrical machinery	58	79	21
Transportation equipment	43	49	6

Source: United Nations Centre on Transnational Corporations, based on R. Newfarmer and W. Mueller, Multinational Corporations in Brazil and Mexico: Structural Sources of Economic and Noneconomic Power (Washington, D.C., Government Printing Office, 1975).

Appendix 7.6

Estimated foreign-controlled shares of output and employment in manufacturing, Argentina, 1955-1972

Year	Estimated percentage of output	Estimated percentage of employment
1955	18	11
1960	21	12
1965	26	11
1970	27	11
1972	31	11

Source: United Nations Centre on Transnational Corporations, based on Banco Central and Censo Industrial of Argentina in International Labour Organisation, El impacto de las empresas transnacionales sobre el empleo y los ingresos: el caso de Argentina, prepared by J. Sourrouille (Geneva, 1976).

Appendix 8

Share of patents registered by foreigners, Chile

Year	Percentage of patents registered by foreigners
1937	65.5
1947	80.0
1958	89.0
1967	94.5
1976	90.0

Source: C.V. Vaitsos, "Patents Revisisted: Their Function in Developing Countries", Journal of Development Studies, Vol. 9, No. 1, October 1972, WIPO, Industrial Property, Geneva, 1977.

Appendix 9

Share of patents registered by non-residents in selected developing countries, 19

Country	1965	1970	1976
Argentina	n.a.	77.7	69.2
Bolivia	n.a.	89.5	86.7
Chile	91.5	93.8	89.5
Colombia	93.4	80.8	78.6
Ecuador	n.a.	96.3	86.7
Ghana	100.0	100.0	100.0
Hong Kong	n.a.	98.6	98.8
India	90.2	83.1	82.6
Iran	93.1	92.7	96.8
Kenya	100.0	100.0	100.0
Korea, Republic of	38.7	25.1	32.5
Morocco	93.5	94.5	93.5
Philippines	96.0	96.5	87.6
Tanzania, United Republic of	100.0	100.0	100.0
Tunisia	95 6	99.3	91.6[a/]
Venezuela	94.5	92.0	84.5[a/]
Zaire	100.0	100.0	92.5
Zambia	n.a.	99.4	98.0[a/]

Source: Based on WIPO, Industrial Property, Geneva, 1977.

a/ 1975.

Appendix 10

Receipts and payments of royalties and fees of selected developing countries
(Millions of dollars)

	1971			1976		
	Receipts	Payments	Balance	Receipts	Payments	Balance
Argentina (1970, 1975)	19	76	-57	34	78	-44
a) management fees and salaries	10	6	+4	16	11	+5
b) royalties	9	70	-61	18	67	-49
Colombia (1970, 1975)	3	10	-7	2	5	-3
Costa Rica (1970, 1975)	--	2	-2	--	3	-3
Ecuador (1970, 1975)	--	--	--	--	27	-27
El Salvador (1970, 1975)	--	2	-2	00	1	-1
Israel	22	28	-6	17	43	-26
Jamaica	--	2	-2	--	5	-5
Korea	22	30	-8	106	65	41
Trinidad and Tobago	--	5	-5	--	8	-8
India (1971-72, 1975-76)	--	26	-26	--	43	-43

Source: International Monetary Fund, Balance of Payments Yearbook, Vol. 28; for India: Indian Investment Centre, Economic News Digest, August 1978.

Appendix 11

Country distribution of estimated total of R and D abroad by United States-based companies

(Percentage)

Country	1966	1975
Canada	22.2	13.1
United Kingdom	24.4	18.8
Common Market	38.9	50.6
Federal Republic of Germany	22.3	29.9
France	9.1	8.1
Belgium	3.2	3.5
Italy	2.6	6.1
Netherlands	1.7	3.0
Switzerland	1.1	2.0
Japan	0.6	0.7
Australia and New Zealand	4.1	3.7
Argentina	1.1	0.6
Brazil	0.7	2.9
Rest of the World	6.9	7.6
Total amount (in millions of dollars)	537	1 331

Source: D. Creamer, "Foreign Research and Development by U.S. Multinational Corporations", Conference Board, New York, 1977.

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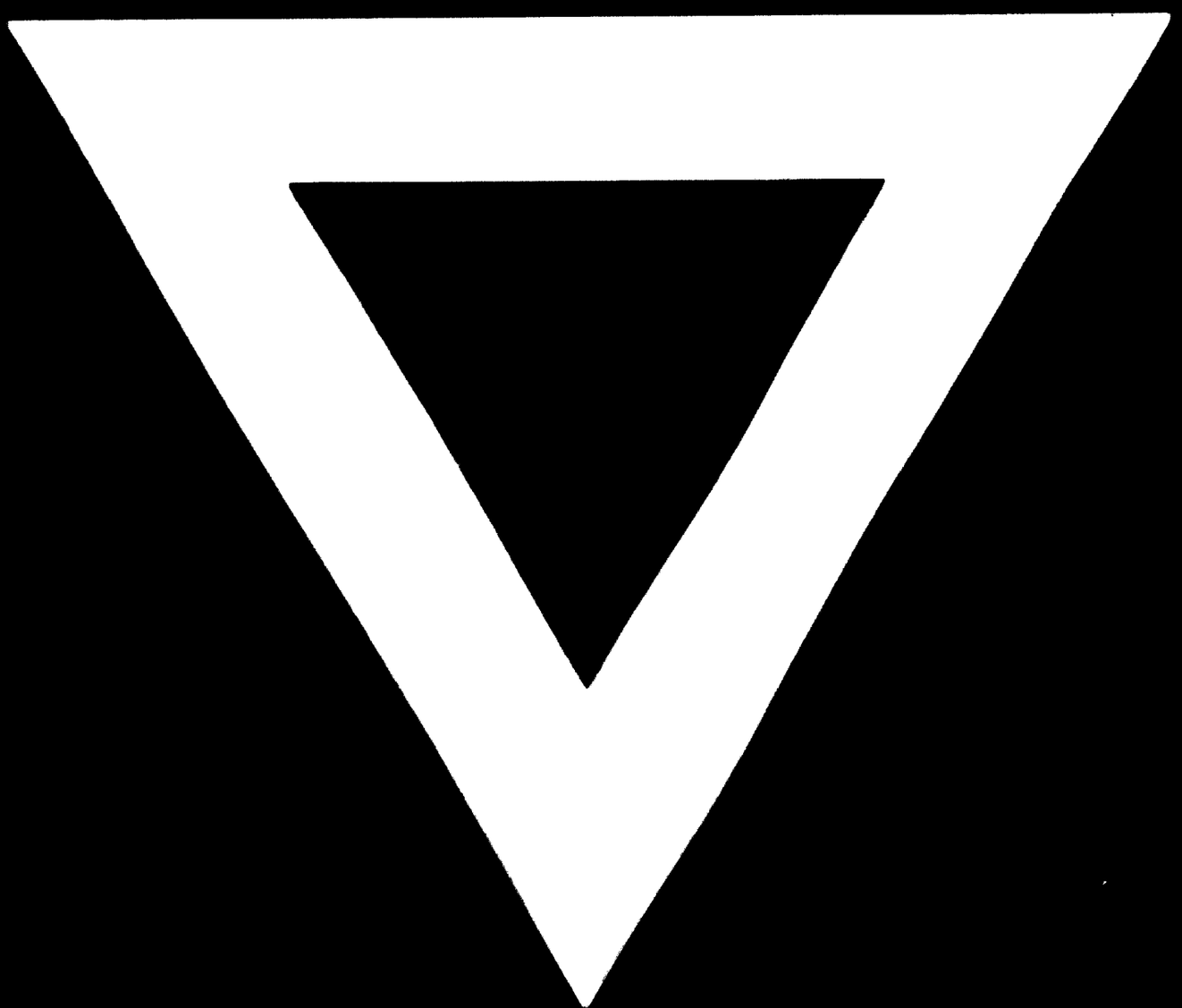

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