

# *Fordham International Law Journal*

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*Volume 11, Issue 4*

1987

*Article 1*

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## Transfer of Technology and Developing Nations

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Michael Blakeney

## **Abstract**

In light of the fact that the considerable diplomatic efforts that have been made toward the promulgation of an international code of conduct on the transfer of technology that might soon be crowned with success, this Article examines the so called "technology development debate." It considers some of the reasons for the determination of developing countries to obtain a commitment from the industrialized countries to adhere to a code of conduct. The Article attempts to evaluate the likely success that the unfettered access of developing countries to advanced technologies will have in promoting economic development. It also identifies some unintended negative consequences that this access might produce. Finally, the Article examines a number of alternative strategies for the technological transformation of developing countries.

# TRANSFER OF TECHNOLOGY AND DEVELOPING NATIONS

*Michael Blakeney\**

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### INTRODUCTION

Following intergovernmental negotiations spanning nearly twenty years, the United Nations may well be on the verge of adopting an international code of conduct on the transfer of technology<sup>1</sup> ("TOT Code"). In July 1964, a resolution of the Economic and Social Council of the United Nations requested the Secretary-General of the United Nations Conference on Trade and Development ("UNCTAD") to examine "the adequacy of existing national and international practices for the transfer of patented and unpatented technology to developing countries."<sup>2</sup> Pursuant to this request, the UNCTAD Secretariat commissioned a number of studies on industrial property rights and on the terms on which technology was being transferred to developing countries,<sup>3</sup> and in 1970, it established an Intergovernmental Group on the Transfer of Technology.

At the meeting of UNCTAD III in Santiago, Chile, in 1972, a unanimous resolution of the participants urged "the developed market countries" to improve the means of access to technology by the less-developed countries, as well as the terms and conditions on which this technology could be obtained.<sup>4</sup> The resolution also charged the Secretary-General of UNCTAD to investigate the possibility of a new international regulation of the transfer of patented and unpatented technology to less-developed countries.<sup>5</sup> In 1974, the Intergovernmental Group received, for its consideration, a draft code of

1. UNCTAD, *Negotiations on a Draft International Code of Conduct on the Transfer of Technology*, UNCTAD Doc. TD/CODE TOT/51 (Oct. 21, 1987) [hereinafter *TOT Code*].

2. ECOSOC Res. 1013 (XXXVII), 37 U.N. ECOSOCOR (Supp. No. 1) at 7, U.N. Doc. E/3970 (1964).

3. For a comprehensive list of these studies see UNCTAD, *Bibliography of Documents on Transfer and Development of Technology*, UNCTAD Doc. TD/B/C.6/INF.2/Rev.5 (1986).

4. UNCTAD Res. 39(III), 3(1) UNCTAD Proceedings at 108, UNCTAD Doc. TD/108 (1972), *reprinted in* Patel, *Transfer of Technology and the Third UNCTAD*, 7 *J. WORLD TRADE L.* 226, 233 (1973).

5. *Id.* at 110, *reprinted in* Patel, *supra* note 4, at 235-37.

conduct for the international transfer of technology prepared by a group of experts under the auspices of the Pugwash Conference on Science and World Affairs.<sup>6</sup> A resolution of the Intergovernmental Group on the Transfer of Technology in July 1974 requested the Secretary-General of UNCTAD to convene a group of experts to investigate the feasibility of a universally applicable code of conduct on the transfer of technology.<sup>7</sup> An Intergovernmental Group of Experts, which convened the following year, affirmed the feasibility of such a code.<sup>8</sup> At the 1975 meetings of this Intergovernmental Group of Experts, proposals for a draft code were presented by Mexico on behalf of the Group of 77 (developing countries) and by the Group B (Western industrialized) countries.<sup>9</sup>

The Group of 77 proposal contained a detailed catalogue of prohibited conduct applicable to all contracts for the transfer of technology, including intra-enterprise transfers and joint venture agreements.<sup>10</sup> The code was expressly intended to be mandatory and contained chapters on preferential treatment for developing countries and on guarantees to be provided by technology suppliers. The Group B proposal was animated by the principle that technology-transfer agreements should contain mutually acceptable obligations. It was expressed to be non-binding and was to apply to a much more limited catalogue of practices and transactions. Subsequently, the Soviet Union, on behalf of the Group D (socialist) countries, endorsed much of the proposal of the Group of 77, with the caveat that the code ought not apply to government transactions.<sup>11</sup>

The Intergovernmental Group of Experts was directed by a resolution of the UNCTAD IV Conference, held at Nairobi in May 1976, to conclude the preparatory work on the TOT Code by mid-1977.<sup>12</sup> The Group of Experts prepared a Draft Code that presented the different positions of each group of coun-

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6. Reprinted in UNCTAD Doc. TD/B/AC.11/L.12 (1974).

7. See UNCTAD Doc. TD/B/520 (1974).

8. UNCTAD, The Possibility and Feasibility of an International Code of Conduct on Transfer of Technology, UNCTAD Doc. TD/B/AC.11/22 (1975).

9. UNCTAD Doc. TD/B/C.6/1 (1975); UNCTAD Doc. TD/B/C.6/14 (1975).

10. See sources cited *supra* note 9.

11. UNCTAD Doc. TD/AC.1/9, Annex II (1975).

12. See Roffe, *UNCTAD: Code of Conduct on Transfer of Technology: A Progress Review*, 12 J. WORLD TRADE L. 351 (1978).

tries and was to be presented to a negotiating conference of the United Nations.<sup>13</sup> The Negotiating Conference, which met in October and November 1978, was unable to overcome the apparent irreconcilability of the positions of the Group of 77 and Group B countries. Further diplomatic rounds in 1979, 1980, 1983, and 1985 produced agreement on all but the restrictive business practice provisions of the TOT Code and the choice of law and enforcement provisions.<sup>14</sup>

Resolution 40/184 of the General Assembly of the United Nations of December 17, 1985 requested the Secretary-General of UNCTAD and the President of the U.N. Negotiating Conference to hold consultations with interested governments on the scope of the issues outstanding on the TOT Code and on appropriate solutions.<sup>15</sup> The Secretary-General of UNCTAD reported on these consultations in October 1986.<sup>16</sup> Because of the optimistic tone of this report, resolution 41/166 of the forty-first session of the General Assembly requested the Secretary of UNCTAD and the Conference President to finalize these consultations in 1987 with a view to a final session of the Negotiating Conference in 1988.<sup>17</sup>

In his most recent report, the Secretary-General of UNCTAD indicated that agreement on all outstanding issues is attainable with the application of the appropriate political will.<sup>18</sup>

In light of the fact that the considerable diplomatic efforts that have been made toward the promulgation of an international code of conduct on the transfer of technology might soon be crowned with success, this Article examines the so-called "technology development debate." It considers some of the reasons for the determination of developing countries to

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13. Report of the Intergovernmental Group of Experts on an International Code of Conduct on the Transfer of Technology to the United Nations Conference on an International Code of Conduct on the Transfer of Technology, UNCTAD Doc. TD/CODE TOT/1 (1978).

14. See UNCTAD, Draft International Code of Conduct on the Transfer of Technology, UNCTAD Doc. TD/CODE TOT/47 (1985).

15. G.A. Res. 40/184, 40 U.N. GAOR Supp. (No. 53) at 146, U.N. Doc. A/40/53 (1985).

16. UNCTAD Doc. TD/CODE TOT/50 (1986).

17. G.A. Res. 41/166, 41 U.N. GAOR (Supp. No. 53) at 132, U.N. Doc. A/41/53 (1986).

18. UNCTAD Doc. TD/CODE TOT/51, ¶ 25 (1987).

obtain a commitment from the industrialized countries to adhere to a code of conduct. The Article attempts to evaluate the likely success that the unfettered access of developing countries to advanced technologies will have in promoting economic development. It also identifies some unintended negative consequences that this access might produce. Finally, the Article examines a number of alternative strategems for the technological transformation of developing countries.

### I. THE RHETORIC OF DEVELOPMENT

The assumption of almost all the proponents of the transfer of technology is that such transfer is a prerequisite, even an imperative, for desirable economic and social development. Solow attributed "87.5% of the growth of per capita income in the United States" in the first half of this century to "technological progress, and the remainder to the use of capital."<sup>19</sup> At the other end of the developmental spectrum, the deprivation and poverty suffered by developing countries has been attributed almost entirely to their technological dependence.<sup>20</sup> In addressing the question of the technological transformation of developing countries, a 1980 UNCTAD report noted that industrialized countries spent between six and seventeen times more of their gross national product on research and development than did developing countries.<sup>21</sup> Further, in developing countries, only one in 10,000 per capita were scientists and engineers, compared with forty-three in market economy countries and eighty-two in socialist countries.<sup>22</sup> The report also noted that developing countries held only 1% of the world total of patents, and that in those developing countries with patent systems 84% were owned by foreigners.<sup>23</sup> Finally, the report observed that 90% of the trade in technology took place among developed nations.<sup>24</sup>

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19. Solow, *Technological Change and the Aggregate Production Function*, 39 REV. ECON. & STATISTICS 312, 320 (1957), cited in Ewing, *UNCTAD and the Transfer of Technology*, 10 J. WORLD TRADE L. 197 (1976).

20. See, e.g., Patel, *The Technological Dependence of Developing Countries*, 12 J. MOD. AFRICAN STUD. 1 (1974).

21. UNCTAD, *Formulation of a Strategy for the Technological Transformation of Developing Countries*, UNCTAD Doc. TD/B/779, ¶ 2 (1980).

22. *Id.*

23. *Id.*

24. *Id.*

UNCTAD also noted that the 75% of the world's population in developing countries contributed only 20% of its income, contributed only 17% of world industrial output, and endured a literacy rate of less than 40%.<sup>25</sup> An unstated assumption in this report is that the technological transformation of developing countries will effect a reversal of these statistics. This reasoning is also reflected in the preamble to the 1980 Model Law for Developing Countries on Inventions,<sup>26</sup> drafted by the World Intellectual Property Organization ("WIPO"). The preamble provides for the adoption of the Model Law by countries, considering:

- (a) the importance of new technology for the economic development and in particular the industrialisation of the country;
- (b) the necessity of creating new technology in the country and of adapting existing technology to needs of the country;
- (c) the necessity of obtaining access to foreign technology.<sup>27</sup>

WIPO's 1977 *Licensing Guide For Developing Countries* commences with the assertion that:

1. Industrialisation is a major objective of developing countries as a means to the attainment of higher levels of well-being of the peoples of such countries. The advancement of science and the development of a technological base are essential conditions of industrial growth.
2. The development of a technological base in a developing country depends on the existence of indigenous technological capacities and the acquisition of selected technology from abroad . . . .<sup>28</sup>

These statements fairly faithfully reflect the philosophy underlying the Declaration on the Establishment of the New International Economic Order ("NIEO"), adopted by the General Assembly of the United Nations in December 1974.<sup>29</sup>

25. *Id.*

26. 1 WIPO, MODEL LAW FOR DEVELOPING COUNTRIES ON INVENTIONS 1 (1980).

27. *Id.* preamble.

28. WIPO, LICENSING GUIDE FOR DEVELOPING COUNTRIES 1 (1977).

29. This Charter sought to give effect to the Declaration on the Establishment of a New International Economic Order, G.A. Res. 3201 (S-VI), 6 Spec. U.N. GAOR (Supp. No. 1) at 3, U.N. Doc. A/9559 (1974), and the Programme of Action on the Establishment of a New International Economic Order, G.A. Res. 3202 (S-VI), 6 Spec. U.N. GAOR (Supp. No. 1) at 5, U.N. Doc. A/9559 (1974).



## II. THE NEW INTERNATIONAL ECONOMIC ORDER (NIEO)

The demand for the establishment of a New International Economic Order represents the expression by developing countries of the policy that is to characterize the third decade of decolonization. This third decade follows the assertion of political independence (1960-1970) and of economic independence (1970-1980). The years 1980 to 1990 were to have witnessed the emancipation of the developing countries from cultural and technological dependence upon Western industrialized states.

The NIEO comprises three components: first, the elimination of the economic dependence of developing countries on developed-country enterprises; second, the promotion of accelerated development of the economies of developing countries on the basis of the principle of self-reliance; and third, the introduction of appropriate institutional changes for the global management of the world resources in the interest of mankind as a whole.<sup>30</sup>

The transfer of technology performs a central role in the NIEO. The Declaration establishing the NIEO provides that one of the governing principles on which the new order is to be established involves "[g]iving to the developing nations access to the achievements of modern science and technology, and promoting the transfer of technology and the creation of indigenous technology for the benefit of the developing countries in forms and in accordance with procedures which are suited to their economies."<sup>31</sup>

Interpreting the Declaration, the proponents of the NIEO assert the right of access of all nations to "the universal heritage" of technology.<sup>32</sup> As a corollary, the right of access is to be secured through the institution of an appropriate legal regime to facilitate technology transfer to developing countries on "equitable" terms.<sup>33</sup>

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30. G.A. Res. 3201 (S-VI), *supra* note 29.

31. *Id.*; see also Hope, *Basic Needs and Technology Transfer Issues in the 'New International Economic Order'*, 42 AM. J. ECON. & SOC. 394 (1983).

32. For an excellent critique of the universal heritage thesis see W. FIKENT-SCHER, *THE DRAFT INTERNATIONAL CODE OF CONDUCT ON THE TRANSFER OF TECHNOLOGY* 25-28 (1980).

33. *Id.*

The Programme of Action announced to inaugurate the NIEO calls for a regulatory code of conduct responsive to the needs of developing countries.<sup>34</sup> An early manifestation of this generally expressed desire for a code of conduct appeared in the Revised Informal Composite Negotiating Text ("RICNT") of the Third Conference on the Law of the Sea<sup>35</sup> ("UNCLOS III"). Article 144 of the RICNT provided for measures to "promote and encourage the transfer to developing countries of such technology and scientific knowledge so that all states Parties benefit therefrom."<sup>36</sup> In the more conventional commercial setting, the access of nations to the "universal technological heritage" is to be secured through the Code of Conduct on the Transfer of Technology,<sup>37</sup> to which all members of the United Nations will subscribe. Additionally, the right of developing nations to technology is to be recognized in a revision of the Convention of Paris for the Protection of Industrial Property.<sup>38</sup>

Both of these legislative initiatives have run into the inevitable difficulty that the industrialized nations do not share the conviction of the developing nations that the expensive technologies developed by the former should be relinquished as if wrongfully acquired at the expense of the formerly colonized nations.<sup>39</sup> However, the New International Economic Order is predicated upon equity in the ordering of technology transactions rather than on the expropriation of technology.<sup>40</sup> To this end, the various United Nations and transnational agencies espousing the NIEO philosophy do little more than to insist upon those same principles of opposition to unfair trading

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34. See Fairley & Rowcliffe, *The UNCTAD Code of Conduct for the International Transfer of Technology: Problems and Prospects*, 18 *CAN. Y.B. INT'L L.* 218, 231 (1980).

35. U.N. Doc. A/CONF.62/WP.10/Rev.1 (1979).

36. *Id.*

37. See Draft International Code of Conduct on the Transfer of Technology, UNCTAD Doc. TD/CODE TOT/47 (1985).

38. Convention of Paris for the Protection of Industrial Property of 20th March, 1883, revised, *opened for signature* Dec. 14, 1900, 13 *U.S.T.* 1 (official English trans.), T.I.A.S. No. 4931; see Kunz-Hallenstein, *The Revision of the International System of Patent Protection in the Interest of Developing Countries*, 10 *IIC STUD.* 649 (1980).

39. The political dimension of this debate is extensively canvassed in P. NANYENYA-TAKIRAMBUDE, *TECHNOLOGY TRANSFER AND INTERNATIONAL LAW* (1980).

40. See the authorities referred to in Fikentscher, *The Draft International Code of Conduct on the Transfer of Technology*, 4 *IIC STUD.* 22-25 (1980).

<sup>41</sup> found in the antitrust statutes of most industrialized nations.<sup>41</sup> Thus, the Draft International Code of Conduct on the Transfer of Technology promulgated by UNCTAD contains a fairly standard catalogue of antitrust prohibitions.<sup>42</sup>

### III. EFFECTS OF TECHNOLOGY TRANSFER

#### A. Overview

The NIEO holds as an article of faith that the transfer of technology to developing nations will improve their material circumstances to levels approaching those of the industrialized nations. The example of the "miracle of Japan" is employed as paradigmatic. This theory proceeds on the assumption that the transfer of technology facilitates the more productive use of resources and provides a technological base for the development of indigenous technology.<sup>43</sup> However, despite the undeniable role played by technology as a catalyst for economic development, it is not the sole determinant of that growth. Moreover, it is questionable whether the use of transfusions of technology as a means of skipping some of the preliminary stages in the development process is either possible or prudent.

The technology available to developing countries has largely been produced for markets in industrialized countries. This technology reflects not only the effective demands, and relative prices, but also the physical, economic, and social environments of those countries. Consequently, the technology that is accessible "off the shelf" to developing countries is likely not to be well suited to their needs. As Hansen explains, "the realization of the developmental objectives is crucially dependent on whether the mechanism of transfer is rightly adapted to the absorptive capacity of the economy."<sup>44</sup>

Additionally, because most technology originates from developed countries, the institutions and legal arrangements

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41. For a comparison of the TOT Code provisions with typical antitrust provisions, see G. CABANELLOS, *ANTITRUST AND DIRECT REGULATION OF INTERNATIONAL TRANSFER OF TECHNOLOGY TRANSACTIONS* (1984).

42. See TOT Code, *supra* note 1, ch. 4.

43. See *MOBILIZING TECHNOLOGY FOR WORLD DEVELOPMENT* (J. Ramesh & C. Weiss eds. 1979).

44. Hansen, *Economic Aspects of Technology Transfer to Developing Countries*, 11 IIC STUD. 429, 430 (1980).

governing technology dissemination have been designed primarily to serve the particular interests of developed countries. Thus, the very notion of industrial property rights is said to reflect the concern in market economies with the sanctity of private property.<sup>45</sup> This sits uncomfortably with the claim of developing countries to technology as a universal heritage. Consequently, the demands of developing countries for access to technology is paralleled by their demands for a restructuring of the legal environment that controls such transfers.

### B. *Foreign Exchange Cost of Technology*

Industrialized market economies dominate international technology trade, while developing countries' participation in such trade is limited. For example, of the US\$2.193 billion received from abroad by United States companies in 1977 in technology license fees and royalties, only 8.1%, or US\$177.6 million, was received from developing countries.<sup>46</sup> Nevertheless, these payments represent a significant economic burden for developing countries, given their limited financial resources. In a 1975 report, UNCTAD estimated the cost to the balance of payments of developing countries (other than those of southern Europe) directly connected with the transfer of technology to be equal to about 5% of their total exports and 8% of their total imports of machinery, equipment, and chemicals. More significantly, these payments represented about 37% of public debt service payments and 56% of the annual flow of direct private foreign investment.<sup>47</sup>

The annual rate of growth of the direct cost to developing countries of technology was estimated by UNCTAD to be about 20%.<sup>48</sup> Added to this amount are various indirect costs associated with such transfers, including consulting and managerial services, transportation, and financial charges associated with technology funding.

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45. See Helleiner, *International Technology Issues: Southern Needs and Northern Responses*, in *THE NEW INTERNATIONAL ECONOMIC ORDER: THE NORTH-SOUTH DEBATE* 295, 296-97 (J.N. Bhagwati ed. 1977).

46. U.S. DEP'T OF COMMERCE, *SURVEY OF CURRENT BUSINESS* 23 (1978).

47. UNCTAD, *Major Issues Arising from the Transfer of Technology to Developing Countries*, UNCTAD Doc. TD/B/AC.11/1, ¶ 98 (1975).

48. *Id.* ¶ 101.

*C. Development and Comparative Advantage*

The supposed efficacy of technology transfer in promoting economic development derives in part from the classic English economic theory of international trade known as comparative advantage.<sup>49</sup> Crudely expressed, this theory explained the nineteenth century economic preeminence of Britain as being attributable to its comparative advantage in capital-to-labor ratios.<sup>50</sup> The gradual recognition of the significance of technology in economic development did little to discredit the classical theory; technological hegemony was simply construed as another factor of comparative advantage enjoyed by the industrial nations.<sup>51</sup> Whatever the veracity of this theory for nineteenth-century Britain, today the comparative advantages of the industrialized nations is reinforced by the restriction of foreign competition through tariffs and quotas imposed upon imports as well as through the maintenance of a manageable population by the restriction of immigration. Thus, it has been observed, "Standards of affluence achieved through labour scarcity and resulting high wages stand to be lost permanently through the development of production of technology-based goods in less developed countries, and this loss is accelerated by the reduction of trade barriers . . . ."<sup>52</sup>

Consequently, the diffusion of technology may result not in the attainment of the high standards of living enjoyed by industrialized nations, but merely in the removal of comparative advantages. Thus the shift of technological skills to low-wage developing countries may result largely in lower prices for developed country consumers rather than higher incomes for developing country producers.

Where technological growth does occur in developing countries, it often redounds to the benefit of an elite class, whose consumption patterns resemble those of the elite in developed countries.<sup>53</sup>

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49. Johnson, *Technological Change and Comparative Advantage: An Advanced Country's Viewpoint*, 9 J. WORLD TRADE L. 1, 8 (1975).

50. See, e.g., J. PARKER, *THE ECONOMICS OF INNOVATION* ch. 2 (1974).

51. See, e.g., J. SCHUMPETER, *THE THEORY OF ECONOMIC DEVELOPMENT* 64 *et seq.* (1959).

52. *Id.* at 8.

53. See Lall, *The Patent System and the Transfer of Technology to Less-Developed Countries*, 10 J. WORLD TRADE L. 1 (1976).

To the extent that high wages in the developing countries reflect the necessary return on the cost of developing technology and the training of skilled labor, the NIEO assumes that the technology exporting companies are prepared to bargain away these development costs and to absorb the risk of labor demands from workers whose wage levels are placed at risk by the trade in technology.<sup>54</sup>

Another factor ignored in the NIEO philosophy is the extent to which technology prices will be bargained up by the competition between developing countries. Technology inflow will inevitably be secured by the offer to multinational corporations of tax and import subsidies, guarantees on the repatriation of royalties and capital and tariff protection. Paradoxically, the expense of this investment to developing countries will encourage in them the same protectionism that the NIEO seeks to break down in the industrialized countries.<sup>55</sup>

#### D. *Growth Through Technology*

Another of the NIEO's articles of faith is the assumption that the transfer of technology will enable developing countries to circumvent the evolutionary process through which the industrialized nations have progressed.<sup>56</sup> It is questionable whether the improvements in factory productivity that technological change can procure serve as an adequate substitute for resource endowment, capital accumulation, and expansion of an educated labor force. The capacity of a technology recipient to participate in international trade is considerably circumscribed because of several circumstances: where it lacks sufficient diversity in resource endowment to permit alteration of production sectors in response to changes in relative prices; where poor educational standards do not permit

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54. See Balogh, *Fact and Fancy in International Relations*, *WORLD DEV.*, Feb. 1973, at 76, 80.

55. On the trade policies of the NIEO, see the articles collected in *THE NEW INTERNATIONAL ECONOMIC ORDER: THE NORTH-SOUTH DEBATE* (J.N. Bhagwati ed. 1977).

56. See Program of Action on the Establishment of a New International Economic Order, G.A. Res. 3202 (S-VI), *supra* note 25, reprinted in 2 *U.N. INST. FOR TRAINING & RESEARCH DOCUMENT SERV. 1, A NEW INTERNATIONAL ECONOMIC ORDER: SELECTED DOCUMENTS 1945-1975*, at 893 (A. Moss & H. Winton comps. n.d.).

the easy transfer of labor from one sector to another; and where capital is limited to role-specific, fixed investments.

It is also questionable whether any amount of technology transfer can overcome the comparative advantages currently enjoyed by the technology-rich countries.<sup>57</sup> Indeed, even the resource endowments of the industrialized nations have been unable to overcome the sometimes considerable inequalities existing among different regions of those countries.

Finally, it is difficult to conceive how the current asymmetries of international trade, where multinational corporations whose incomes vastly exceed the gross national product of all the developing nations (excepting China and India)<sup>58</sup> can be reversed merely by improving the terms on which those corporations transfer their technology. However, seen over the longer term, the positive effects of technology transfer can be identified. Industrialization has been occurring in developing countries, sometimes at spectacular rates. One effect of this has been that developing countries are enjoying an increasing share of world trade.<sup>59</sup> Additionally, imported technologies have been the source of a horizontal diffusion of technological skills; labor skills developed to service a particular technology import then became available for other industries and for export.

#### E. *Appropriateness of Technology*

Hansen identifies a sequence of three stages of economic development, each characterized by a different capacity for absorption of technology.<sup>60</sup> At the earliest stage of development there is little indigenous capacity for research and an almost

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57. For example, in the British context, see Cooke, *Dependency, Supply Factors and Uneven Development in Wales and Other Problem Regions*, 16 REGIONAL STUD. 211 (1982); Holland, *Capital, Labour and the Regions: Aspects of Economic, Social and Political Inequality in Regional Theory and Policy*, in SPATIAL INEQUALITIES AND REGIONAL DEVELOPMENT 185-218 (H. Folmer & J. Oosterhaven eds. 1977).

58. See U.N. ECONOMIC & SOCIAL COUNCIL, COMM'N ON TRANSNATIONAL CORP., TRANSNATIONAL CORPORATIONS IN WORLD DEVELOPMENT: A REEXAMINATION, U.N. Doc. E/C.10/38, at 254, 259 (1978), U.N. Sales No. E.78.II.A.5.

59. For example, OECD imports from developing countries in the 10 years from 1970 through 1979 increased at an annual average rate of about 22%, while OECD imports to developing countries were running at 26.3% in 1979. OECD, NORTH/SOUTH TECHNOLOGY TRANSFER: THE ADJUSTMENTS AHEAD 54 (1981).

60. Hansen, *supra* note 44, at 432-39.

total reliance on foreign technology. In addition to the technology itself, the supplier must also provide relevant management and skilled labor. The appropriate method of transfer at this stage is usually through turn-key arrangements. This is because there will be a lack of both expertise in the working of patents and designs and of the skills necessary for the maintenance and repair of capital goods.

Next, direct foreign investment and the establishment of industrial plants will lead to the development of a skilled workforce, together with marketing and distributorship networks. At this second stage, foreign technology can be adapted and applied by indigenous nationals. The import of capital goods and the transfer of technology through licensing agreements also becomes appropriate. The third stage of development is characterized by the establishment of a significant capacity for imitative research, with the developing country becoming an exporter of technology in its own right. At the third stage, technology can be transferred through joint venture arrangements, including joint research agreements.

Although Hansen's analysis is useful in understanding the theory of development, her theory is subject to certain practical constraints. The multinational corporations most likely to be the source of technology for developing countries will not necessarily be offering a technology that has been specifically developed for developing countries. For example, much of the agricultural research in the industrialized countries is concerned with improving mechanization to avoid labor expenditures. This research is obviously going to be of little relevance to small-scale cultivators in labor-abundant circumstances. Griffin asserts that over half the research conducted in the rich capitalist countries is of no immediate relevance to the development of poor countries.<sup>61</sup> He suggests that research on defense, space, and atomic energy are harmful to developing countries, and that research on synthetic substitutes to natural products such as jute, cotton, silk, and rubber are prejudicial to the interests of some poor countries.

The small size of technology markets in developing countries, and hence the limited profit-making opportunities they

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61. Griffin, *The International Transmission of Inequality*, *WORLD DEV.*, Mar. 1974, at 3, 4.



offer, will usually mean that technology exporters will not adapt their wares to the particular circumstances of developing countries. Rather, corporations will either offer the same technology that they sell in developed countries or possibly technology that they can no longer sell in those countries because it has become outmoded.<sup>62</sup>

One of the most important economic limitations of the suitability of technology for importation by a developing country is the capital expenditure required to utilize such technology. Technology developed in an industrialized nation is designed based upon a presumption of the availability of both a fairly sophisticated infrastructure and the ready availability of investment reserves.<sup>63</sup> These facilities are simply not available in developing countries. For example, the higher education levels of industrialized countries produce higher managerial and labor skills. Technologies based on the assumption of those skills will require their emulation before that technology can be effectively integrated.

The attempt by developing countries to leap stages of development by the importation of technology may lead to the omission of essential stages in industrial evolution. The skill of a labor force develops at more or less the same pace as the technology developed for that labor force. To transplant technology significantly in advance of the technological skills of the recipient economy will mean both that the technology is ineptly utilized, and that the relevant expertise is not given an opportunity to develop.<sup>64</sup>

The high wage rates of industrialized countries are a reflection of high labor productivity. They also act as an incentive for innovators to introduce technology that minimizes the input of this expensive labor. To an extent, this is reflected in the utilization of large-scale mechanized units in industrial production. The markets in developing countries are often not sufficiently extensive to support this scale of production.

At the social welfare level, the appropriateness of technol-

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62. See W. CHUDSON, *THE INTERNATIONAL TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES* ch. 1 (1971).

63. See Hawrylshyn, *Capital Intensity Biases in Developing Country Technology Choices*, 5 J. DEV. ECON. 215 (1978).

64. See Todd & Simpson, *The Appropriate-Technology Question in a Regional Context*, 18 GROWTH & CHANGE 46 (1983).

ogy is assessed in terms of its impact upon socioeconomic structures. The impact of mechanization upon employment in a labor-intensive economy is an obvious issue in determining the appropriateness of technology. Transplanting the type of mechanized, vehicular transport available in an industrialized economy to a rural economy, in which animal power is the principal source of locomotion, can also prove to be inappropriate.

Consumer goods from developed countries may satisfy entirely different needs from those felt by consumers in developing countries. For example, intensively advertised, brand-name garments offer consumers in industrialized countries attributes of prestige and modishness that may be entirely inappropriate in a rural community where the evanescence of fashion is subordinate to considerations of garment quality and longevity. On the other hand, advertising and brand promotion of consumer goods, even in the least developed countries, may create the same sort of consumer demand as that in developed countries, along with the additional appeal of a vicarious association with the life-style of developed countries. In these circumstances, developing countries must judge whether to allocate any resources to obtaining such goods.<sup>65</sup>

The psychological factors relevant in the acquisition by persons in developing countries of consumer items associated with the more opulent circumstances of developed countries have been identified as influencing the acquisition of inappropriate technology by developing countries. The most common examples are the acquisition of national airlines, nuclear weapons, and a space program.<sup>66</sup> Other social welfare aspects of technology transfer include the environmental, health, and safety impacts of transfer.

Because economic growth has been identified as the primary objective of technology transfer, the non-economic im-

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65. For further research, see the authorities referred to in J. REIFFERS, *TRANSNATIONAL CORPORATIONS AND ENDOGENOUS DEVELOPMENT* 283-90 (1982).

66. At a more mundane level, Streeten mentions the example of a United States manufacturer of toilet paper perforating machinery who was unable to dispose of obsolete saw-tooth perforating equipment in three developing countries when these perforations became unfashionable in the United States for the reason that the superseded perforations would be inconsistent with the dignity of consumers in those countries. P. STREETEN, *THE FRONTIERS OF DEVELOPMENT STUDIES* 387 n.1 (1972).

pact of technology tends not to be considered significant. The Bhopal disaster of December 3, 1984, may be cited as a consequence of this attitude. That disaster was caused by the failure of safety devices in a pesticide plant that permitted the escape of lethal gases, killing some 2500 people and probably causing long-term damage to the health of thousands of other people who were exposed. It has been suggested that, in part, the Bhopal disaster was precipitated by a failure to install expensive safety devices that would have made the pesticide plant a less attractive investment for the United States owner.<sup>67</sup> Indeed, it has been suggested that some multinational corporations establish dangerous factories in developing countries to escape stringent domestic health and environmental law.<sup>68</sup> The Chernobyl disaster is a vivid illustration of the ultimately global effects of pollution, such that the environmental impact of technology transfer has implications for both the exporting and recipient nations. The developing country, by eschewing health and safety concerns in pursuit of short-term economic gains, may mean that in the long term it will be unable to secure the quality of life promised by economic development.

A final non-economic factor that may have an important bearing on the appropriateness of technology is the political economy within which it is received. According to Galtung's structure theory, every technology is associated with a particular social, economic, and cognitive structure.<sup>69</sup> The structure associated with a technology "produces, filters out and accepts only the techniques that will be accompanied by such structures, thereby reinforcing the structures themselves."<sup>70</sup> Where a proposed technology poses a threat to existing power groups, whether political, scientific, or governmental, that technology will invariably fail to obtain the support necessary for its success. For example, an antiquated land tenure system

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67. See Ashford & Nyers, *Policy Issues for Consideration in Transferring Technology to Developing Countries*, 12 *ECOLOGY L. J.* 4 (1985).

68. See Castleman, *The Export of Hazardous Factories to Developing Countries*, 9 *INT'L J. HEALTH SERVICES* 569 (1979).

69. I am indebted for this analysis to Stewart, *Macro Policies for Appropriate Technology: An Introductory Classification*, in *TECHNOLOGY, INSTITUTIONS AND GOVERNMENT POLICIES* 27 (J. James & S. Watanabe eds. 1985).

70. Galtung, *The North/South Debate: Technology, Basic Human Needs and the New International Economic Order*, World Order Models Project, Working Paper No. 12, at 133 (1980).

may prevent the adoption of modern agricultural techniques, such as selective breeding, crop specialization, and irrigation. Multiple decision-making organs and a complex bureaucracy thus may inhibit entrepreneurship.

A history of domination by an industrialized colonial power may produce a residual cultural domination such that scientists and engineers historically look to the colonial parent for their technological education. The result is the inculcation of skills and values inappropriate to the former colony's circumstances.<sup>71</sup> This type of influence is responsible in part for the emigration of scientists and engineers from developing countries. Significantly, the magnitude of this "brain drain" is considered to outweigh the flow of technical assistance to developing countries.<sup>72</sup>

#### F. Technology Markets

Legislative strategies for controlling technology transfers are invariably conceived of as interventions in the markets in which technology is traded. However, to speak of a "market" for technology is misleading. Unlike other economic goods, technology is not produced directly for supply. Frequently it is only available as part of a composite transaction involving goods or plant and machinery. Some technology is available for sale, but increasingly technology can be disseminated only through direct investment.

Technology is manifested in diverse forms, ranging from fairly simple agricultural implements to very complex computer systems. A distinction may be drawn between "conventional technology" and "high technology."<sup>73</sup> The former includes, for example, the technology in the shoe, textile, paper, and cement industries. High technology industries are characterized by very large "research and development expenditure, a large element of complex patented or non-patented proprietary technology, rapid and continuing technological change,

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71. See, e.g., K.P. WONG, THE CULTURAL IMPACT OF MULTINATIONAL CORPORATIONS IN SINGAPORE (1979); Godfrey & Langdon, *Partners in Underdevelopment? The Transnationalization Thesis in a Kenya Context*, in TRANSNATIONAL CAPITALISM AND NATIONAL DEVELOPMENT 84-111 (J. Villamil ed. 1979).

72. See UNCTAD, *The Reverse Transfer of Technology: A Survey of Its Main Features Causes and Policy Implications*, UNCTAD Doc. TD/B/C.6/47 (1979).

73. W. CHUDSON, *supra* note 62, at 16-18.

high capital requirements, a stake in maximizing the profits or quasi-rents on this high technology and product differentiation."<sup>74</sup> Markets for conventional technology tend to be a good deal more competitive than those for high technology. Consequently, strategies for controlling technology transfer are likely to be more effective in the conventional technology markets, where they are less needed.<sup>75</sup>

The overwhelming proportion of high technology creation is concentrated within a few multinational firms and in only a few sectors of industry. Thus, a 1970 OECD survey indicated that in the United States the eight largest firms accounted for over one third of total expenditures on research and development, and the forty largest firms accounted for 70%.<sup>76</sup> This survey indicated that over three quarters of research and development expenditure was absorbed by the aircraft, electronic, and chemical industries. Additionally, the fact that the targets of regulation often control assets that easily outstrip the national product of the developing country often inhibits strategizing by the regulator to control the terms on which technology is transferred by these corporations.

In the concentrated markets for high technology, transfers tend to be direct, through the establishment of subsidiaries, and to a lesser extent through joint ventures. On the other hand, in the more competitive markets for conventional technology, transfers more frequently involve licensing, turn-key projects, and management contracts.<sup>77</sup>

The efficacy with which the transfer of technology can be regulated is often a reflection of the bargaining power of the respective parties. The small share in the international trade in technology enjoyed by developing countries is in part a reflection of the inappropriateness of much Western technology, and in part a consequence of the perception by the vendors of technology that those countries represent inadequate returns and unacceptable investment risks.<sup>78</sup> In these circumstances,

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74. *Id.* at 19.

75. *Id.*

76. See OECD, *GAPS IN TECHNOLOGY: ANALYTICAL REPORT* (1970).

77. See Greer, *Control of Terms and Conditions for International Transfers of Technology to Developing Countries*, in *COMPETITION IN INTERNATIONAL BUSINESS* 42, 52 (O. Schachter & R. Hellawell eds. 1981).

78. See the authorities referred to in Henry, *Political Risks in Patent Licensing*, in 4

the capacity of developing countries to regulate the terms of technology trade is considerably circumscribed.

#### IV. *LIMITATIONS ON THE ACCESS TO TECHNOLOGY*

##### A. *Overview*

Considerable scholarly attention has been devoted to examination of the prevalent restrictions on Third World technology transfer.<sup>79</sup> These restrictions represent, in varying degrees, limitations on the access of developing countries to technology. These limitations typically entail: (a) tied purchases of additional goods or services; (b) restrictions on exports; (c) the imposition of onerous guarantees; (d) restrictions on competition in the domestic market; and (e) constraints limiting the dynamic effects of the transfer.<sup>80</sup> A 1970 questionnaire addressed by UNCTAD to all technology-receiving developing countries indicated that nearly all replying countries were subject to one or more of these limitations in their technology transactions.<sup>81</sup> Similar results have been found in surveys of licensing agreements in Australia,<sup>82</sup> Canada,<sup>83</sup> and the United Kingdom.<sup>84</sup>

##### B. *Typical Restrictions*

###### 1. *Tie-Ins*

The most common vendor-imposed restriction identified in the 1970 UNCTAD survey was the conditioning of supply of

THE LAW AND BUSINESS OF LICENSING 520.391, 520.401-.405 (M. Finnegan & R. Goldscheider eds. 1980).

79. For a recent survey of this literature, see G. CABANELLAS, *supra* note 41.

80. For a comprehensive list of the types of restrictive provisions contained in technology transfers to developing countries, see UNCTAD, *Control of Restrictive Practices in Transfer of Technology Transactions*, UNCTAD Doc. TD/B/C.6/72 (1982); UNCTAD, *Major Issues Arising from the Transfer of Technology to Developing Countries*, UNCTAD Doc. TD/B/AC.11/10/Rev.2, ¶ 38 (1975).

81. See UNCTAD Doc. TD/B/AC.11/10/Rev. 2, *supra* note 80.

82. See studies referred to in T. MANDEVILLE, D. LAMBERTON & E. BISHOP, *ECONOMIC EFFECTS OF THE AUSTRALIAN PATENTS SYSTEM* 164-71 (1982).

83. Firestone reported that "in 85 percent of cases export limitations were attached to patents licensed in Canada." O.J. FIRESTONE, *ECONOMIC IMPLICATIONS OF PATENTS* 153 (1971); see also S. OSTRY, *WORKING PAPER ON PATENT LAW REVISION* 80 (1976).

84. See C. TAYLOR & A. SILBERSTON, *THE ECONOMIC IMPACT OF THE PATENT SYSTEM* 372-73 (1973).

technology on the purchase of intermediate products, capital equipment, spare parts, and even designated personnel.<sup>85</sup> An inevitable effect of these tie-ins is to prevent the technology acquirer from obtaining these ancillary goods and services from the most competitive sources of supply. As a consequence, even where an item of technology is offered to purchasers in developing countries at what appears to be a favorable price, the invariable overpricing of the tied products represents a hidden cost of the transfer.

Not only do tie-ins affect production costs through the overpricing of inputs, but they also may have indirect adverse effects on development. For example, economic growth in the developing country will be inhibited to the extent that the opportunity to produce the ancillary products and services will be denied to the technology acquirer. Invariably the products that are tied in will have to be imported from the foreign technology supplier or its related enterprises, with further deleterious foreign exchange implications.<sup>86</sup>

## 2. Export Restrictions

Replies to the 1970 UNCTAD questionnaire indicated that technology acquirers in developing countries were commonly subject to both direct and indirect controls on exports. For example, 99%, 97%, and 93% of agreements, in Peru, Mexico, and Chile, respectively, contained export restrictions.<sup>87</sup> These restrictions took a variety of forms, ranging from express total prohibitions on exports, through permissible exports of designated products to designated markets, and to market share arrangements implied between parent and subsidiary enterprises. Of these provisions, total prohibitions and the necessity for prior approval were most common.<sup>88</sup>

The obvious impact of this category of restrictions is to hamper the growth of industries within developing countries, depriving them of the benefits of the generalized system of preferences and of regional integration and cooperation.

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85. UNCTAD Doc. TD/B/AC.11/10/Rev.2, *supra* note 80, ¶ 38.

86. For the effects of tying on developing countries see *id.* ¶¶ 44-52.

87. *Id.* ¶ 58.

88. *Id.*

### 3. Requirement of Guarantees

To minimize some of the investment risks in developing countries, technology suppliers have insisted on guarantees concerning royalties, tax rates, tariffs, and exchange rates. Variations in the amounts of the above that are adverse to the technology supplier are offset by compensatory payments to technology suppliers to reimburse them for any losses they may suffer as a result of state controls over royalty rates and the like. The obvious effect of such guarantees is to frustrate the policy objectives of any state-inspired variation of these amounts.

### 4. Competition Restrictions

Certain technology license clauses restrict the ability of the acquirer either to compete directly with the supplier or to deal with the supplier's competitors. Additionally, technology suppliers have obtained tariff protection against the import of competitive goods as well as monopoly rights over sources of raw materials.<sup>89</sup> Often these advantages are supplemented by securing local patent protection to prevent the entry of competitive products.<sup>90</sup> The effect of these provisions is not only to constrict the markets open to developing countries, but also to limit the range and sources of technology available to the acquirer.

Clauses in acquisition agreements obliging the receiver of technology to manufacture its products in strict compliance with the specifications of foreign technology suppliers are a particular problem for developing countries. This obligation prevents the necessary adaptation of imported technology to accord with local circumstances and to be appropriate for domestic consumption.

#### *C. Impact of Limitations to Technology Access*

The comprehensive cataloguing by UNCTAD<sup>91</sup> and others<sup>92</sup> of restrictive provisions that have appeared in indus-

89. *Id.* ¶ 80.

90. See Vaitsos, *Patents Revisited: Their Function in Developing Countries*, 9 J. DEV. STUDS. 71, 77-79 (1972).

91. UNCTAD Doc. TD/B/C.6/72, *supra* note 80.

92. See Greer, *The Case Against Patent Systems in Less-Developed Countries*, 8 J. INT'L L.



trial property licensing agreements has presupposed the inherent inequity of such provisions. Indeed, their characterization as inhibiting access to technology<sup>93</sup> has emphasized this supposed propensity. On the other hand, it has been suggested that these restrictions enhance the tailoring of the subject matter of technology transfer agreements to ensure that acquirers pay for no more than they actually require. For example, McFetridge and Smith assert that:

Market restrictions and unilateral grantbacks allow the licensee a contractual method of renouncing markets for and uses of a technology for which he does not wish to pay. If such a renunciation is prohibited licensors will have to allow for the possibility of the licensee's use of the technology for purposes and markets for which he has no interest. As a consequence the cost of the licensing arrangement is increased.<sup>94</sup>

Similarly, tie-ins are explained as a useful low-cost measure of the intensity of use of a technology. Where the alternative is to charge an average price for the technology, the small user will be disadvantaged by the higher price it will be obliged to pay.<sup>95</sup>

According to UNCTAD, the widespread condemnations by developing countries of the restrictions contained in industrial property licences may indicate either that the cost savings argument has not been accepted, or that those savings can be realized by means other than the imposition of restrictive conditions.<sup>96</sup> What is particularly important is that the duration and ambit of such restraints do not exceed that which is reasonable for the exploitation of the industrial property right at issue.

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& ECON. 223 (1973); Vaitos, *The Revision of the International Patent System: Legal Considerations for a Third World Position*, 4 WORLD DEV. 85 (1976); Timberg, *Restrictive Business Practices in the International Transfer and Diffusion of Technology*, in COMPETITION IN INTERNATIONAL BUSINESS, *supra* note 77, at 84.

93. *E.g.*, UNCTAD Doc. TD/B/AC.11/10/Rev.2, *supra* note 80, ch. II.

94. D. MCFETRIDGE & D. SMITH, PROPERTY RIGHTS AND TECHNOLOGY TRANSFER 73 (1979) (Report to Canadian Department of Consumer and Corporate Affairs).

95. *Id.* at 75.

96. UNCTAD, *The Role of the Patent System in the Transfer of Technology to Developing Countries*, UNCTAD Doc. TD/B/AC.11/19/Rev.1, at 23-29 (1975).

V. *LESSONS FOR THE FUTURE*

The theoretical and practical deficiencies of technology transfer as a means of development do not gainsay its function as a catalyst for economic development. However, in light of the problems mentioned above, technology transfer is no longer treated as a panacea for development. Current scholarship is directed toward resolution of these problems and ways in which to render the transfer of technology more effective in its developmental role.<sup>97</sup>

A. *Restructuring the Legal Environment*

As has been emphasized above, the international legal environment encompassing transfers of technology evolved in response to the particular requirements of the industrialized countries that dominate the technology market. As a consequence, demands by developing countries for the restructuring of the legal environment assume a central role in the NIEO. However, given the insignificant commercial position of the developing countries in technology markets, the types of regulatory stratagems to which developing countries can resort are of the soft, non-prohibitory variety. Principal among these is the encouragement of voluntary codes of conduct, such as that promoted in the UNCTAD Code of Conduct on the Transfer of Technology and a similar code of conduct for multinational corporations.<sup>98</sup>

Another touchstone of the practicability of reconstructing the legal environment is the ongoing process of revision of the Paris Convention for the Protection of Industrial Property.<sup>99</sup>

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97. See, e.g., A. BHALLA, D. JAMES & Y. STEVENS, *BLENDING OF NEW AND TRADITIONAL TECHNOLOGIES* (1986); *INTEGRATION OF EMERGING AND TRADITIONAL TECHNOLOGIES* (E. von Weizacker, N. Swaminathan & A. Lemma eds. 1983); *TECHNOLOGICAL CHOICE AND CHANGE IN DEVELOPING COUNTRIES: INTERNAL AND EXTERNAL CONSTRAINTS* (B. Lucas & S. Friedman eds. 1983).

98. See Set of Multilaterally Agreed Equitable Principles and Rules for the Control of Restrictive Business Practices Having Adverse Effects on International Trade, UNCTAD Doc. TD/RBP/CONF/1 (July 1978); see also Greenhill, *UNCTAD Control of Restrictive Business Practices*, 12 *J. WORLD TRADE L.* 67 (1978); Joelson, *The Proposed International Code of Conduct as Related to Restrictive Business Practices*, 8 *LAW & POL'Y INT'L BUS.* 837 (1976).

99. For a discussion, see Andereg, *The Proposed Revision of the Paris Convention for the Protection of Industrial Property—The Position of the Developed Countries*, in A.B.A., *CURRENT INTERNATIONAL LEGAL ASPECTS OF LICENSING AND INTELLECTUAL PROPERTY* 134-

The ownership by foreign nationals of the vast majority of the industrial property rights registered in developing countries,<sup>100</sup> pursuant to the Paris Convention, means that the latter are devoting scarce resources to administer a system which is perceived to have overtones of foreign domination. As a trade-off, the developing countries are seeking some limitations to the scope of application of the Paris Convention.<sup>101</sup>

The difficulties attending the negotiation of a code that is binding merely in honor,<sup>102</sup> as well as the revision of the Paris Convention,<sup>103</sup> illustrate the magnitude of legal reconstruction in this area. These experiences suggest that the diametrical interests of the developed and developing countries can be reconciled only through fairly bland expressions of intention.

### B. *Enriching Market Information*

As in markets for more conventional goods, the information available to technology consumers plays a very important role. The vendors of technology, like any other product, are interested in supplying their most profitable items. The selective offerings of these vendors have often been the sole source of the information to developing countries on the technology that is available. Thus it has become imperative for developing countries to be capable of forming their own evaluations of the appropriateness of the technologies being offered. Some of the strategies of the NIEO are directed to this end. As early as 1973, the United Nations Industrial Development Organization ("UNIDO") issued guidelines to assist developing countries in negotiating technology licenses.<sup>104</sup> A more comprehensive set of guidelines was issued in 1977 by the World In-

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65 (1980); Kirk, *Revision of the Paris Convention for the Protection of Industrial Property—Major Issues of Interest to Developing Countries*, in A.B.A., CURRENT INTERNATIONAL LEGAL ASPECTS OF LICENSING AND INTELLECTUAL PROPERTY 1-19 (1980).

100. It has been estimated that developing countries own only about 1% of the world stock of patents, UNCTAD Doc. TD/B/AC.11/19/Rev.1, *supra* note 96, ¶ 263, and about 2.2% of all foreign trademarks, UNCTAD, *The Role of Trade Marks in Developing Countries*, UNCTAD Doc. TD/B/C.6/AC.3/3/Rev.1, ¶ 104 (1979).

101. See Kunz-Hallenstein, *supra* note 38, at 649.

102. See W. FIKENTSCHER, *supra* note 32.

103. See Kunz-Hallenstein, *supra* note 38.

104. U.N. INDUS. DEV. ORG., GUIDELINES FOR THE ACQUISITION OF FOREIGN TECHNOLOGY IN DEVELOPING COUNTRIES, WITH SPECIAL REFERENCE TO TECHNOLOGY LICENSE AGREEMENTS, U.N. Doc. ID/98, U.N. Sales No. E.73.II.B.1 (1973).

tellectual Property Organization.<sup>105</sup> In 1976, UNCTAD established its Advisory Service on the Transfer of Technology.<sup>106</sup> The purpose of this Service is to provide assistance in the formulation and implementation of technology planning in developing countries, including the establishment and modification of institutional infrastructures to implement technology programs.<sup>107</sup> UNIDO also makes available consultants to assist nations in evaluating available technology packages.<sup>108</sup>

One limitation of the information services available is that they are helpful in evaluating technology packages that have been offered to target consumers, but they do not indicate the range of comparable packages available. Various suggestions have been made for the establishment of technology information collecting centers to provide information not only as to the availability, cost and technical specifications of plant, but also regarding the scale, labor requirements, product nature, input nature, and likely repair cost of available plant.<sup>109</sup> Regional centers for cooperation in the development and transfer of technology are in the course of being established in Africa, Asia, and Latin America.<sup>110</sup>

### C. *Development of Appropriate Technologies*

Because the vast majority of expenditure on research and development ("R&D") is devoted to the particular problems of the developed countries,<sup>111</sup> it is necessary, in the short run, to focus on establishing techniques for the modification of tech-

105. WIPO PUB. NO. 620(E), LICENSING GUIDE FOR DEVELOPING COUNTRIES (1977).

106. See Planning the Technological Transformation of Developing Countries, UNCTAD Doc. TD/B/C.6/59.4 (1980); Technology Planning in Developing Countries, UNCTAD Doc. TD/238/Supp.1 (1979).

107. Planning the Technological Transformation of Developing Countries, UNCTAD Doc. TD/B/C.6/59.4 (1980); Technology Planning in Developing Countries, UNCTAD Doc. TD/238/Supp.1 (1979).

108. Legal Aspects of Technology Transfer: Current Activities of International Organizations Within the United Nations System, U.N. Doc. A/CN.9/269, at 22 (1985).

109. Stewart, *Technology and Employment in LDCs*, WORLD DEV., Mar. 1974, at 17, 36.

110. UNCTAD, Promotion and Encouragement of Technological Innovation, A Selective Review of Policies and Instruments, UNCTAD Doc. TD/B/C.6/139, ¶¶ 56-62 (1986).

111. Helleiner refers to an estimate of only two percent of research being addressed to the problems of developing countries. Helleiner, *supra* note 45, at 307.

nology for the purposes of developing countries. An obvious example is the greater use of manual labor, such as in construction and transportation projects.

For the future it is obviously necessary to increase the amount of R&D relevant to developing countries. This will occur in the industrialized countries without compulsion as the developing countries assume a greater significance as purchasers of technology. To hasten the process, developing countries should use regional cooperation agreements to aggregate their market power in collective purchasing arrangements and joint marketing ventures. On an individual level, developing countries can offer tax, tariff, and exchange rate incentives to those multinational corporations prepared to offer appropriate technologies.

Ideally, the developing countries should themselves undertake the task of modifying available technologies into appropriate forms. Some successes have been achieved in the field of agricultural research by jointly operated agricultural research institutes.<sup>112</sup> Joint agricultural research has been supplemented by the establishment of cooperative schemes for the marketing of primary products.<sup>113</sup>

One of the factors leading to the acquisition of inappropriate technology is the importance of commercial considerations in research and development decisions. Many of the shortcomings of this form of technology generation can be overcome by non-commercial aid programs operated by governments or international organizations.<sup>114</sup> To date, the promise of this form of assistance has not been realized, largely because of the shortage of the very special know-how involved in adaptive technology.<sup>115</sup>

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112. See Evenson, *Technology Generation in Agriculture*, in *AGRICULTURE IN DEVELOPMENT THEORY* 192-223 (L. Reynolds ed. 1975).

113. For a comprehensive list see Adebajo, *Economic Co-operation Among Developing Countries: A Component of International Development Strategy*, in *UNCTAD AND THE SOUTH-NORTH DIALOGUE* 175, 198-99 (M. Cutajar ed. 1985).

114. See *INNOVATION POLICIES: AN INTERNATIONAL PERSPECTIVE* (G. Sweeney ed. 1985); R. ROTHWELL & W. ZEGVELD, *INDUSTRIAL INNOVATION AND PUBLIC POLICY* (1981).

115. See OECD, *REPORT ON THE WORKSHOP ON THE EVALUATION OF THE EFFECTIVENESS OF GOVERNMENT MEASURES FOR THE STIMULATION OF INNOVATION* (1984).

### D. *Development of Indigenous Technological Capacity*

The object of developing countries in technology transfers is to enhance their technological capacity. As this capacity is enhanced, each generation of indigenous technology will render subsequent transfers less significant. The initiatives of international agencies such as UNCTAD, UNIDO, and WIPO simultaneously relate transfer strategies to the transformation of developing countries.

#### 1. National Technology Policies

Individual developing countries have been encouraged to formulate national technology policies as an integral part of their national development program. Such policies are recommended to include "the determination of technological priorities, mobilization of natural resources, dissemination of the existing national stock of technology, identification of the sectors in which imported technology would be required and determination of R&D priorities for the development and improvement of endogenous technologies."<sup>116</sup> Central to the institution of national technology planning is the establishment of national technology planning centers to direct and coordinate the deployment of technology toward those sectors of the economy where it is required.<sup>117</sup>

UNCTAD recommends, as an integral part of technology planning, the allocation of a specific portion of the national budget for research and development. It proposes target amounts of 2% of Gross National Product to be spent on research and development by 1990 and 3% by 2000.<sup>118</sup>

##### a. *Tax Incentives for Technological Development*

One of the oldest incentives for the promotion of R&D in developed market economy countries is the provision of taxation relief. Such incentives have invariably been based on the deduction of R&D operating expenditure from taxable income, and the offer of depreciation allowances on capital expenditure. In some countries, tax credits are employed either as an

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116. UNCTAD, *Formulation of a Strategy for the Technological Transformation of Developing Countries*, UNCTAD Doc. TD/B/779, ¶ 7 (1980).

117. *Id.* ¶ 10.

118. *Id.*

incentive to stimulate investment in a specified technology sector or as a general incentive for incremental expenditure on R&D.<sup>119</sup> For example, the Australian Government recently introduced a 150% tax concession for the first six years of a company's expenditure on a R&D project.<sup>120</sup> Likewise, tax credits of between 25% and 50% for incremental R&D expenditures are available in the United States, Canada, and Japan.<sup>121</sup>

The efficacy of tax relief as an incentive for R&D in market economy countries has not been sufficiently explored. However, an obvious advantage of a tax incentive policy is that it extends the opportunity for innovation to less successful firms by easing their cash flow problems, and thus enabling them to carry forward their operating losses.<sup>122</sup>

Although the smaller fiscal resources of developing countries constrain the extent of tax incentives that can be offered to encourage technological innovation, tax incentive policies have been adopted by a number of partially industrialized developing countries.<sup>123</sup> In the Republic of Korea, firms with R&D expenditures are offered a choice between a 10% tax credit or a 50% accelerated depreciation allowance.<sup>124</sup> In Singapore, an investment allowance of up to 50% is granted to firms planning to incur expenditures for R&D.<sup>125</sup> In Malaysia an allowance of 33 1/3% is offered to firms which incur capital expenditures on general R&D.<sup>126</sup> This allowance is increased to 50% for expenditures devoted to improving technologies in agricultural based industries. In Mexico a 20% tax credit is granted for capital expenditures on R&D.<sup>127</sup> Finally, in Peru, up to 10% of the net income of a firm planning to incur R&D expenditures can be deducted from income tax where these expenditures exceed 2% of net income and the research project is carried out in collaboration with a national university.<sup>128</sup>

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119. See UNCTAD Doc. TD/B/C.6/139, *supra* note 110, ¶ 7.

120. *Id.* ¶ 7.

121. *Id.*

122. *Id.* ¶ 8.

123. *Id.* ¶ 26.

124. *Id.*

125. *Id.*

126. *Id.*

127. *Id.*

128. *Id.*

b. *Direct Financial Assistance*

A number of developed countries offer a variety of forms of direct financial incentives to firms to encourage research and development.<sup>129</sup> These include grants, loan assistance and risk-sharing investment. Direct financial assistance can be offered as a means of supporting the R&D activities of smaller enterprises or in stimulating particular industrial sectors. In particular, direct financial assistance is used in France, the Federal Republic of Germany, and the United States to encourage R&D in high technology industries such as microelectronics, information technology, biotechnology, robotics, and nuclear technology.<sup>130</sup>

In developing countries, financial assistance schemes are more widely used than tax incentives to encourage R&D.<sup>131</sup> Direct loans for approved R&D projects are provided in the Republic of Korea, Singapore and Colombia. For example, in 1981 the government of Singapore introduced a Research and Development Assistance Scheme to assist R&D projects of "national importance and technological significance."<sup>132</sup> Similarly, in 1980, the Republic of Korea established the Special Research and Development Projects Scheme to provide financial support to enterprises for the development of technologies in high risk industries, or where large capital investment is required.<sup>133</sup>

Argentina, Mexico, and the Republic of Korea have introduced a number of risk-sharing schemes.<sup>134</sup> In Mexico, the Consejo Nacional de Ciencia y Tecnologia ("CONACYT") administers a risk-sharing scheme under which it assumes up to 75% of the cost of a technological development project. Reimbursement of the funds granted under the scheme is required only if the project is successful. The Korea Technology Development Corporation participates in the equity of new, technology-intensive firms and provides conditional loans, remunerating itself through sales if the firm's products are successfully introduced into the market. At a lower level of risk-

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129. *Id.* ¶¶ 10-20.

130. *Id.* ¶¶ 13-16.

131. *Id.* ¶¶ 27-31.

132. *Id.* ¶ 27.

133. *Id.* ¶ 27.

134. *Id.* ¶¶ 28-30.



sharing involvement, the Instituto Nacional de Tecnologia Industrial ("INTI") of Argentina provides the use of its laboratory facilities and the assistance of its technical staff for technological projects. The obligation of firms to pay for these services is conditional upon the success of the relevant project.

Among the other financial incentives developing countries offer to encourage the development of indigenous technology are the provision of loans on favorable terms for technology projects, usually, through state-owned financial institutions established for this purpose. For example, in Brazil the Financiadora de Estudos e Projetos ("FINEP") provides funding for technological projects.<sup>135</sup> Additionally, some countries provide financial incentives to encourage collaborative research through universities. Thus, for example, the Apoio a Empresa Nacional ("ADTEN") program of FINEP grants financial credits at low rates of interest to firms that conduct their research through universities or research institutes.<sup>136</sup> CONACYT in Mexico provides funding on a similar basis.<sup>137</sup>

The facility with which the governments of developing countries can provide financial incentives for indigenous technological development depends upon the funds available to them. Beside the funds that can be obtained through foreign aid and through the United Nations Financing System for Science and Technology,<sup>138</sup> a possible indigenous source of financial incentive is government procurement policy. A recent study of a number of key industries in the United States stresses the importance of government procurement in influencing innovation and industrial change.<sup>139</sup> It pointed out that

the relevant government agencies deliberately tried to induce the development of products that were suited for their purposes. The vehicles employed included procurement contracts written so as to cover the R&D cost of the particular design (a disguised form of R&D support), direct R&D

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135. UNCTAD, *Policies Laws and Regulations on the Transfer, Application and Development of Technology*, Periodic Report 1986, UNCTAD Doc. TD/B/C.6/133, ¶ 42 (1986).

136. *Id.* ¶ 44.

137. *Id.* ¶ 47.

138. G.A. Res. 218, 34 U.N. GAOR (Supp. No. 46) at 153, 155-57, U.N. Doc. A/34/46 (1979).

139. See *GOVERNMENT AND TECHNICAL PROGRESS: A CROSS-INDUSTRY ANALYSIS* (R. Nelson ed. 1982).

support associated with a procurement contract, and support of basic and generic research.<sup>140</sup>

The example provided by those developed countries that employ public procurement policies to marshal their limited resources to induce industry to focus its technological initiatives in specified areas<sup>141</sup> has an obvious relevance for developing countries.

### *c. National Research Institutes*

Indirect financial assistance can be provided for firms in developing countries through the establishment of national research institutes that undertake the sort of infrastructure research that might not be attractive to private commercial enterprises. Examples of these institutes are the Centre for Technological Innovation ("CIT") in Mexico and the Institute for Industrial Technology Research ("ITINTEC") in Peru. Both the CIT and ITINTEC provide personnel training, technological advice, and production support services for industrial enterprises.<sup>142</sup> The latter include product testing and quality control, as well as product modification.<sup>143</sup>

The record of national research institutes in developing countries has been unsatisfactory, partly because of the inadequacy of resources and largely because of poor linkages with industry.<sup>144</sup> The poor linkages have been attributed to (a) the inadequate dissemination of information about the activities of institutes; (b) the lack of agencies for the commercialization of the R&D activities of the institutes; and (c) the failure of these institutes to meet the technological needs of the private sector.<sup>145</sup> The most difficult of these problems will be identifying the particular R&D needs of indigenous industries.<sup>146</sup>

140. *Id.* at 460.

141. See also R. ROTHWELL & W. ZEGVELD, *supra* note 114.

142. UNCTAD Doc. TD/B/C.6/139, *supra* note 110, ¶ 31.

143. *Id.*

144. See UNDP/UNIDO, *INDUSTRIAL RESEARCH AND SERVICE INDUSTRIES*, Evaluation Report No. 6 (1982).

145. UNCTAD Doc. TD/B/C.6/139, *supra* note 110, ¶¶ 56-60.

146. See Dahlman & Westphal, *Technological Effort in Industrial Development and Interpretive Survey of Recent Research*, in *THE ECONOMICS OF NEW TECHNOLOGY IN DEVELOPING COUNTRIES* 105-37 (F. Stewart & J. James eds. 1982).

## 2. Collective Self-Reliance

Parallel to the achievement of indigenous technological autonomy has been the progress towards greater technological self-sufficiency among developing nations, as part of the current direction of the NIEO towards collective self-reliance for developing countries. Collective self-reliance as a policy for developing countries was articulated for the first time at a conference organized in 1976 by The Group of 77 at Mexico City, and again at Arusha, in 1979.<sup>147</sup> A comprehensive Programme of Action was adopted by the High-Level Conference on Economic Co-operation among Developing Countries at Caracas in May 1981. The Caracas Programme addressed the seven interrelated areas of trade, technology, food, agriculture, energy, raw materials, finance, and industrialization.<sup>148</sup> It sought to rationalize technological research efforts among developing countries. To this end it launched the Development Communication Network ("DEVNET") as a clearinghouse for information on development projects conducted in developing countries.

As part of the policy of commercial self-reliance, a number of regional centers on technology have been established. Among the functions that these centers will perform are: (i) the joint acquisition of technology; (ii) cooperative arrangements for consulting, design and engineering services; (iii) joint research and development; (iv) establishment of information systems on all matters pertaining to the acquisition, adaptation, development, and utilization of technology; and (v) the establishment of intergovernmental centers in economic sectors of critical importance.<sup>149</sup> Infrastructure projects are particularly suited to joint development by these centers because such undertakings might not be of interest to commercial transferors of technology. Examples include the manufacture of machine tools, boat building, and the processing of raw materials.

The emerging notion of technological integration, in

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147. Arusha Programme for Collective Self-Reliance and Framework for Negotiations, adopted Feb. 15, 1979, *reprinted in* UNCTAD Doc. TD/CODE TOT/CRP.1 (1979).

148. See Guerro, *Collective Self-Reliance: Turning a Concept into a Reality*, in UNCTAD AND THE SOUTH-NORTH DIALOGUE, *supra* note 113, at 235, 235-42.

149. UNCTAD Doc. TD/B/779, *supra* note 116, ¶ 11.

which the technological needs of developing countries are satisfied on a regional basis, has evolved logically from the concept of self-reliance through joint technological cooperation. In this way, not only are the economies of scale from the aggregation of market power realized, but opportunities for the establishment of intra-regional specializations are also attracted.

### 3. Decommmercialization of Technology

UNCTAD has recommended that the large number of technologies available in the public domain in developed countries should be made freely available to developing countries.<sup>150</sup> Pursuant to this recommendation, UNCTAD proposes the establishment of registers of available technology. More controversially, UNCTAD has recommended the decommercialization of technology "in those areas which cater to the satisfaction of critical needs of developing countries—for example, pharmaceuticals, food and food processing, housing and building materials, public transport, telecommunications, and energy supplies."<sup>151</sup>

### 4. Control of Transnational Corporations

In addition to the codes of practice dealing with the transfer of technology by transnational corporations, UNCTAD has proposed the institution of controls over the technology activities of subsidiaries of transnational corporations located in developing countries. Essentially these controls require subsidiaries of transnational corporations to realign their research and development activities to coincide with the technological priorities of their host countries.<sup>152</sup> Among the detailed recommendations is the obligation for subsidiaries to "cooperate with developing countries in their efforts to establish a 'critical mass' of scientific, technological and managerial manpower through the institution of in-plant training facilities, support to national training institutions . . . and the establishment and development of consultancy services."<sup>153</sup> Subsidiaries are also

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150. *Id.* ¶ 13.

151. *Id.*

152. *Id.* ¶ 15.

153. *Id.*

obliged to replace any scientists or technologists from developed countries with those from the host country. An obvious problem with this sort of proposal is that they become another cost for the transnational corporation in dealing with a developing country. If that cost becomes too high, either those dealings will cease, or some alternative to direct investment will be selected as the commercial basis for technology transfers.

### 5. Funding

The establishment of essential technological infrastructure burdens developing countries with expenses that are not immediately recoverable. The various multilateral cooperative ventures reduce these expenses to an extent. The United Nations Financing System for Science and Technology<sup>154</sup> promises to provide a source of funding for strengthening the scientific and technological capacities of developing countries.

### CONCLUSION

At the end of the Second World War, anthropologists in New Guinea became concerned that a number of the native tribes were abandoning their traditional hunting and gathering activities to camp around large strips of land that the tribes had cleared, apparently for religious purposes, in the tropical jungle. It transpired that these tribes observed an unloading of United States Army cargo planes supplying the U.S. military forces in the area. Having experienced what was to them a supernatural arrival, the tribes then endeavored to encourage the return of these god-like planes by the construction of air strips. As we have seen, there is much in the technology development debate that shares something of the cargo-cult mentality of the New Guinea tribes. It will be important to avoid the problems that this mentality can easily engender in developing countries in their efforts to procure the most appropriate technologies for their circumstances and their attempts to combine technology procurement with the development of indigenous technology.

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154. G.A. Res. 218, 34 U.N. GAOR (Supp. No. 46) at 153, U.N. Doc. A/34/46 (1979).