Florida State University Journal of Transnational Law & Policy

Volume 3 | Issue 1 Article 10

1994

U.S. Science Policy and the International Transfer of Technology

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U.S. SCIENCE POLICY AND THE INTERNATIONAL TRANSFER OF TECHNOLOGY

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"*Science policy is not and cannot be the subject of value-free inquiry.*"[1]

INTRODUCTION

A specific area of regulation yet untouched by the recent metamorphosis in international relations due primarily to the end of the Cold War, is the transfer of technology and its domestic conformation in U.S. science policy.[2]

This article re-examines the issues surrounding technology transfer. What constitutes technology transfer? What is the role of science policy in technology transfer? What relationship, if any, does technology transfer have with intellectual property laws? How significant is this relationship to the process of international technology transfer? How should this relationship be (re)defined and (re)constructed in the post-Cold War global market place? What is the effect of technology transfer on a nation's innovative and productive ability?

The analysis is necessitated by, and thus framed, in the specific context of the transformation of Eastern European, African and Latin American economies through the process of privatization, and the genesis of industrial capitalism in the burgeoning economies of the Newly Industrialized Countries (NIC's) of Asia. It is also set against the background of deepening political and economic malaise in the nascent democracies of Third World countries.

The central thesis maintains that international technology transfer from the U.S. is significantly restricted, if possible at all, under the existing construct of legislation regulating intellectual property rights and scientific research. This is so, the argument suggests,

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1. BRUCE SMITH, AMERICAN SCIENCE POLICY AFTER WORLD WAR TWO 7 (1990).

2. Technology is used in this sense to refer to basic and applied technology of a non-military classification, which can be utilized for the production of goods and services. Changes which have so far taken place in the regulation of technology relate to the export of high technology goods to the Eastern block. These changes were primarily made under the auspices of the Coordinating Committee on Multilateral Export Controls (COCOM). *See Controls on Telecommunications Eased Under New Rule*, INT'L TRADE DAILY (BNA) Dec. 28, 1992.

partly because of the lack of conceptual clarity of the ideology of international technology transfer, and partly the result of an incongruous U.S. science policy which championed the cause of American industry in the post-World War Two era and fostered the consolidation of American hegemony throughout the Cold War period.[3] Today U.S. science policy continues a legacy of regulatory incoherence while consistently maintaining the objective of domestic economic advancement through government patronage of scientific endeavor. The social cost is spread through an intricate framework of legislation governing science, scientists, international sales[4]/trade, and intellectual property.

The real impact, however, is more clearly seen in the international marketplace. U.S. science policy has hindered the international transfer of technology, foreclosed investment opportunities for small business owners, and thus has contributed to the decline of freely-available information necessary for the success of industrialization in less-developed countries.[5] This is observed particularly as post-industrial, post-modern, market commodities are juxtaposed with commodities from pre-industrial, pre-modern societies which are also active participants in the global market. While a substantial amount of literature and debate has examined the technology gap between developed and less developed countries, contemporary reality still suggests that the availability of goods in the global market from less technologically advanced countries, not to mention their competitiveness, is increasingly disproportionate to what is available from the West. The success or otherwise of the experiment in market economies in the Eastern bloc, the tentative steps towards democracy in several countries of Africa and Latin America all require, for sustained success, a sound technological base to facilitate production and enhance competitive ability in the international market.[6] Ultimately, the triumph of democratic governance in these

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3. SMITH, *supra* note 1.

4. Military and defense-based rules are not the primary focus of this article, although dual-use goods are referred to tangentially. All theoretical constructions should thus be construed outside of the context of national security.

5. ZEINAB A. KARAKE, TECHNOLOGY AND DEVELOPING ECONOMIES: THE IMPACT OF EASTERN EUROPEAN VERSUS WESTERN TECHNOLOGY TRANSFER 99-100 (1990). Karake asserts that U.S. policies are less advantageous to developing countries, stating "The U.S. policies affecting technology transfer have been more restraining and have placed . . . emphasis on military and security concerns . . .."

6. Eastern Europe certainly has more of an industrial base than say Africa for example. However, this does not preclude the need for advanced technology for the more efficient production of goods and services as the region enters the world market. *See generally* JAN MONKIEWICZ, INTERNATIONAL TECHNOLOGY FLOWS AND THE TECHNOLOGY GAP: THE

parts of the world will be directly related to, and dependent on, the productiveness of their domestic economies.

Part I is a brief overview of technology transfer, focusing on the history of U.S. science policy, its relation to domestic economic policy and its impact on international technological interdependence.

Part II examines the relationship between science technology and intellectual property.

Part III analyzes the concept of technology transfer within domestic boundaries. It explores the role of intellectual property laws[7] in science policy and conflicts between scientific research norms, public policy and the commercialization of scientific results. It then proceeds to delineate the role of technology, its importance to industry, and its conformation in science policy.

Part IV examines the international transfer of technology and its articulation as a legal phenomena. A comparative analysis is used to point out problems in legal arrangements traditionally used in the process of international technology transfer.

Part V concludes with a restatement of the results of the paradigmatic comparison and the implications both for science policy and the international transfer of technology.

PART I

A. A History of US. Science Policy

> The economic philosophy behind the clause empowering Congress to grant patents and copyrights is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare . . .[8]

When, in the early eighties, there was a noticeable decline in U.S. productivity and competitiveness in the world market—the government, lobbied by private industry, began to pursue a vigorous program to curtail the trade deficit and, consequently, the loss of revenue flows to the domestic economy. This grand scheme effectively combined national legislation with international agreements to combat the tide of capital loss in private industry. A significant focus was on the infringement of U.S. intellectual property rights outside domestic borders, the predominant amount of which is

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EXPERIENCE OF EASTERN EUROPEAN SOCIALIST COUNTRIES IN INTERNATIONAL PERSPECTIVE (1989).

7. Intellectual property issues will be limited to patent and copyright laws.

8. Mazer v. Stein, 347 U.S. 201, 219 (1954).

reportedly done by less developed countries.[9] As such, these countries have become the focus of U.S. trade sanctions,[10] or other methods of reprisal.[11]

Intellectual property refers to tangible or intangible goods which are the result of creative efforts of the mind. Intellectual property rights are the legal expression of the protection available to the "offspring of . . . intellect." Legally-protectable intellectual goods are defined as such within the legal system, which recognizes the property-oriented rights to own the results of creative activity. Various laws establish the aggregate of rights, protect the product and regulate its appropriation.

Intellectual property law, however, goes further than the simple enumeration of rights and duties. It also gives the holder of the right a monopoly over the ownership and use of the intellectual good.[12] A patent, for example, gives exclusive rights of exploitation of an idea for seventeen years,[13] while copyright subsists for the lifetime of the author and 50 years.[14]

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9. Under section 301 of the 1974 Trade Act (as amended by the 1988 Trade Act) the United States Trade Representative (USTR) is required to present a list of countries which "deny adequate and effective protection to U.S. intellectual property." This is "Special 301,"in contrast to "Super 301," the now-expired omnibus provision of the Trade and Tariff Act of 1984. Super 301 targeted all foreign trade practices regarded as unfair to U.S. business interests. The violation of intellectual property rights could, arguably, have been covered under Super 301. However, Special 301 made it mandatory for the USTR to present to Congress, names of specific countries that violated U.S. intellectual property rights, therefore removing the discretion previously granted by Super 301. *See* Trade Expansion Act of 1992, H.R. 5100, 102nd Cong. 2nd Sess. (1992).

10. *Id. See also infra,* text accompanying note 8.

11. Other methods of dealing with countries identified as unfair trading partners include bilateral negotiations such as undertaken with Japan (automobiles) and Canada (lumber). *See Big Three Likely to Press Clinton on Japanese Imports,* THE WASH. POST (BNA) January 6, 1993. Available on Lexis/Nexis. *See also U.S, China Agreement on Intellectual Property Ends Retaliatory Duties Threat,* INT'L TRADE DAILY (BNA), January 21, 1992.

12. The law protects only the first inventor who must disclose the invention in order to receive the patent grant. 35 U.S.C. §§ 101-102 (1988). This long-standing principle of intellectual property law is expressed in the "first to invent" principle of U.S. patent laws. The objective of this is consistent with the central objective of the monopoly grant which is to encourage the dissemination of new information, with the ultimate goal of enhancing public welfare. As far back as the early nineteenth century, British courts had maintained that

> He is not called the inventor who has in his closet invented it but does not communicate it; the first person who discloses that invention to the public is considered as the inventor though another may have invented it and concealed it.

Lord Lyndhurst in Househill Co. v. Neckson, 1 Webst. 719.

13. 35 U.S.C. § 154 (1988). Patent lengths vary from country to country.

14. 17 U.S.C. § 302.

When Congress enacted the first Patent statute in 1790,[15] the cardinal issues of the time were political questions of civil governance and the building of a new republic. As with most of Europe, science was not perceived as a necessary part of political or social engineering for the new nation. The American Revolution had cut the nation off from the legal flow of scientific information from Europe,[16] leaving the development of science—in its conceptual and practical conformation—to the rising civil society, and philanthropic organizations.[17] The result was that science, like the arts, was supported primarily by beneficent donors.[18]

While several of the Founding Fathers were men learned in rudimentary science and, persuaded about its value, linked scientific knowledge to the welfare of the nation,[19] the tension between the philosophy of limited government and the private nature of scientific research prevented direct government participation in science, either through funding or policy regulation. As a result, applied science mushroomed mainly in private quarters but received state approval in the form of the intellectual property system which provided economic incentives for creative activity.[20]

An elementary utilitarian conception of science dominated the relationship between science and government for over a century,[21] only to subside initially in the wake of World War One and then World War Two, as the need for applied science towards military resources impelled governmental involvement in scientific inquiry.[22] Prior to World War One, scientists were not particularly enthusiastic about government interest in their work.[23] With the Cold War however, came the social consensus which dictated that science, now "nationalized," should respond to national policy demands. The

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15. This first act was short-lived because the government had little or insufficient interest to devote the needed time to apply it. A new law was passed in 1793 which simplified the process. This remained effective until 1836. 17 ENCYCLOPEDIA BRITANNICA 370 (1961).

16. SMITH, *supra* note 1, at 18, 23.

17. *Id.*

18. *Id.* at 2.

See also THOMAS FESSENDEN, AN ESSAY ON THE LAW OF PATENTS FOR NEW INVENTIONS (1810): "In the U.S. useful inventions have still stronger claims on public patronage . . . the public can be the only efficient patrons of men of inventive faculties. . .." *Id.* at xxxi, xxxvii.

19 SMITH, *supra* note 1.

20. This system of economic incentives was based on the granting of patents. Prior to 1836, patents were issued without any examination for novelty. Under the then-existing law (the Patent Act of 1793) patents were being issued at the rate of 600 per year. The inefficiencies of the system finally led to the promulgation of a new act in 1836. ENCYCLOPEDIA BRITANNICA, *supra* note 15.

21. SMITH, *supra* note 1. *See generally* chapters 1 and 2.

22. J.W. GROVE, IN DEFENCE OF SCIENCE: SCIENCE, TECHNOLOGY AND POLITICS IN MODERN SOCIETY 25, 31, 71-72 (1989); SMITH, *supra* note 1, at 36.

23. LEONARD A. COLE, POLITICS AND THE RESTRAINT OF SCIENCE 3 (1983).

consensus directed research towards the development of new processes suitable for governmental objectives.[24] This cold war focus dominated science policy for much of the twentieth century, emphasizing scientific results applicable for military use.[25]

With governmental involvement in science, the guidelines for scientific endeavor were enlarged both in scope and relevance to domestic economy. Scientists, historians, and other intellectuals disagree over the extent of the post-war impetus for specialized scientific inquiry.[26] There is, however, a fragile consensus that the post-war years witnessed the reformation of the role of government in fostering scientific endeavor.[27] The dominating influence of post-war rivalries over American public life created an intellectual momentum that succeeded in breaking through the separation between science and government patronage.[28] The American public began to associate scientific progress with national security and with the preservation of American democracy and freedom of thought.[29] Nationalism thus displaced the hitherto inchoate ideology of science in the nation and propelled the crystallization of a "science policy."[30] Scientific research, applied and basic, was perceived as the means to successfully achieve wider social objectives. These objectives would embrace and link all spheres of public life—from foreign policy priorities to industrial innovation to academic institutions and, finally, to the manufacturing sector of American business which was the economic base of the nations' free enterprise system, as well as the springboard for American global leadership.

There was, in effect, a post-World War Two transformation in the ideology of science. The dominance of benevolent utilitarianism in determining the role of science in society was displaced, though not subsumed, by the conscious utilization of science to meet a wide range of national goals.[31] There was now, in a sense, a "post-war

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24. GROVE, *supra* note 22, at 49.

25. SMITH, *supra* note 1, at 49. Though the Civil War had caused similar trends in the use of science, technological issues were not "motivating factors" in the achievement of governmental objectives.

26. COLE, *supra* note 23. *See also* GROVE, *supra* note 22.

27. *Id. See also* SMITH, *supra* note 1, at 40.

28. SMITH, *supra* note 1, at 71.

29. Dale A. Nance, *Forward: Owning Ideas* (Symposium on Law and Philosophy), 13 HARV. J.L. & PUB. POL'Y 757 at 760 (1990).

30. SMITH, *supra.*

31. This was not the first time this synthesis occurred. Some scholars have suggested that earlier in history, government had realized that unless the scientific knowledge base were enlarged, improvements in the rudiments of life could not take place. Thus, in government agencies, pure science and practical knowledge were used to effectively carry out plans and designs for infrastructure and agricultural purposes. *See* SMITH *supra*, COLE *supra*, NELKIN *infra* at note 41.

consensus" that there was a need for governmental support of basic and applied research. The skepticism which greeted basic research in the nineteenth century, the reticence that the constitutional and political jurisprudence of the day had evoked in the minds of the public regarding governmental support of scientific endeavor, and the idea of "a self-governing science" were no longer operative.[32]

The new consensus brought about a revolution in the acceptance of government involvement in science. The "loose pluralism" of the nineteenth century had given way to the "scientific democracy" of the twentieth century where government had, in effect, received a mandate to regulate scientific endeavor by engaging in it itself.[33]

Amid the multiplicity of objectives science policy and its development in the post-war era, commercialization, spurred by the needs of European post-war reconstruction efforts, formed the focal point. The commercialization of science, more than anything else, provided the first conceptual focus of science policy, namely, to increase the scientific base of the nation and thus to facilitate and enhance productivity in the private sector. This focus was inextricably linked to the wider concern for national security through technological supremacy.

While there was no structured policy framework within which national objectives were coherently articulated, government action after World War Two began to reflect a conscious and overt support for basic and applied research.[34] What was loosely termed "science policy" consisted of an elaborate scheme of legislation and guidelines which regulated scientific effort in universities and government agencies, encouraged the use of scientific information to enhance the manufacture and production of goods and services, and established programs for private industry participation in coordinating and supporting scientific research. There was, however, no conceptual framework which provided the foundation for the plethora of executive and legislative proposals which informed "science in policy," as distinct from "policy in science," the two being distinct from a cognate "science policy."[35] Thus, outside of national objectives of a decided macroeconomic nature, science policy was simply the management of scientific endeavor—an institutional attempt to balance the weight of governmental involvement in science to conform to the political agenda, and to do so without stifling knowledge which would be useful for private industry.

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32. SMITH, *supra* note 1. *See generally* Chapter 3.
33. *Id.*
34. *Id.*
35. GROVE, *supra.*

Modern U.S. science policy can be defined as a body of legislative and executive mandates concerned with expanding the scientific base of the nation through the promotion and commercialization of scientific discoveries, with the ultimate objective of achieving broad social goals. Put succinctly,

> [T]he central idea [for science policy] was the absence of an idea; . . . since policy decisions could affect the framework for discovery, the matter should not be viewed in absolute terms.[36]

Although the significance of scientific research to the economic and political agenda increased at a rate comparable to no other sphere in American public life,[37] the use of research to achieve social ends was, initially, a slow process.[38] In the myriad of structural changes in national and foreign policy engendered by the cold war there was a rapid growth in research and development funding.[39]

The institution of independent scientists long gone, the direct participation of government in science, coordinated through funding programs for universities, arrangements with private contractors and the establishment of government research centers, involved more than just the flow of capital to fund scientific inquiry. It also meant that government had significant control over the direction of scientific research. As a result, the large scale commercialization of applied science could have been successfully achieved without the intellectual property system which, at least in American jurisprudence, created a right to own one's ideas and the corresponding right to sell them. However, the existence of an intellectural property system allowed, by default, a cooperative effort to emerge between government and private industry. It was industry's role to develop products; it was the government's role to support and create incentives for the market place through policies which defined areas of government interest in research, and which provided the capital to support the research.[40] In addition to the provision of capital, the government through its research centers and universities, employed

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36. SMITH, *supra* note 1. There is still no single document or legislation that constitutes national science policy. *See* 15 U.S.C. § 3701(8) (1988): "No comprehensive national policy exists to enhance technological innovation for commercial public purposes. There is a need for such a policy . . .."

37. Today, the amount of capital invested in research and development has decreased both comparatively to other industrialized nations, and in real terms, over the past decade. Reasons for this include, among others, the reportedly short-sightedness of American industry and the "fluid" nature of corporate regulation.

38. SMITH, *supra* note 1, at 19.

39. *Id.* at 39.

40. *Id.* at 59. "Only through research and more research can we provide basis for an expanding economy and continued high levels of employment."

scientists whose research was geared primarily for government use. These arrangements between scientists and the government inevitably led to questions of ownership of scientific data and the ideas derived from federally-sponsored research. Scientists assert that these disputes were for the most part contained within science disciplines, since "property rights in science are whittled down to a bare minimum by the rationale of the scientific ethic. The scientist's claim to his intellectual property is limited to that of recognition and esteem."[41]

The latent ambiguities in science policy and the inchoate social agreement between government and scientific endeavor generated an intricate network of conflicts, complicated by a plethora of policy and legal guidelines. The problems can be grouped into two categories. The first category involves conflicts between policy objectives and the ethics of science, aptly described as the "individual sovereignty of scientific behavior."[42] The second category involves conflicts arising out of the commercialization of technology and its transfer across national boundaries, either as goods and services or as pure scientific data.

The tension between policy objectives and the ethics of science is perhaps best indicated by the comment that

> Scientists resist external control as threat to the quality and integrity of research and as an infringement on their right to control the production and dissemination of their work.[43]

Or as one scientist puts it:

> The process that I want to call scientific is a process that involves the continual apprehension of meaning . . . that constitute understanding, done by me and can be done for me by no one else. They are as *private* as my toothache and without them, science is doomed.[44]

As far back as Galileo, scientists have shared information in the process of research and experimentation. Indeed, in most disciplines the process of creativity is one which requires and encourages the participation of other members of a given epistemic community through critique, debate, recommendation, etc. However, an ingenious mix of export control laws, intellectual property laws and science policy have placed significant restrictions on the freedom of

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41. DOROTHY NELKIN, SCIENCE AS INTELLECTUAL PROPERTY: WHO CONTROLS RESEARCH 6 (1983).

42. *Id.* at 5.

43. *Id.*

44. *Id.* (emphasis added).

the scientific community to share information developed in public and private laboratories across the United States. With the government's direct sponsorship of scientific endeavor, the noose has increasingly tightened over the academic freedom of the scientific community. Government restrictions on the dissemination of scientific results, either in the form of data or finished products, are justified on grounds of national security or national defense, casting an impenetrable shield around government activity in science. The problem is made worse by the assertion by members of the scientific community that government often places national security obligations on *non*-classified research, blurring the distinctions between civilian and military research.[45] What is ironic is that science policy is specifically designed to encourage the free flow of information between industries and across national boundaries.[46] As one scholar has noted, confusion in science policy stems from the difficulty in separating science and technology from the wider social ends to which they are but ends.[47]

Beyond the inconsistent rules which make up science policy, and the conflicts with the principle of open communication in the ethics of science, is the fact that with the availability of technology in the international market from a growing number of sources, together with the end of the cold war, science policy must be restructured in a way that permits the flourishing of scientific endeavor for the benefit of an international community that is increasingly besieged by environmental and health hazards of a magnitude previously unknown in modern history. In addition to the benefits for research in areas common to the international community, a scientific community free from the restraints of a stifling science policy would encourage mutual free flows of information across national boundaries, and make available productive knowledge to those who are capable of utilizing it for the development or production of goods and services.

B. Modern Trends in Science Policy and Domestic Technology Transfer

With the increase in international competition and the decline in research and development investment, Congress passed several pieces of legislation geared to stimulate innovation in private industry and to provide access to technology available from the Federal

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45. *Id.* at 8.
46. *See* Exec. Order No. 12591, § 4, 3 C.F.R. 1987.
47. SMITH, *supra* note 1.

Government. Of the various Acts passed, the Federal Technology Transfer Act[48] and the Stevenson-Wydler Technology Innovation Act of 1980[49] are worthy of note as specifically affecting the international transfer of technology in their policy objectives. In addition, several executive orders were passed under the Reagan administration that required certain government agencies to make foreign technology in their possession accessible to private industry.[50] This framework of export control laws and intellectual property laws extended the reach of the post-war cooperation between government and industry to all spheres of private business, resulting in more government control and correspondingly, the overall decrease of technology that could flow freely across national boundaries.

As the ownership versus control controversy continues in the scientific community, private industry pushes for technology transfer from the public domain of government laboratories to private industry, but not beyond.[51]

Section four of Executive Order No. 1259,[52] for example, prvides that "The Secretaries of State Commerce, and the Director of the National Science Foundation shall develop a central mechanism for the prompt and efficient dissemination of science and technology information developed abroad . . .."[53] This is to "ensure that the United States benefits from and fully exploits scientific research and technology developed abroad."[54] By limiting the rights of scientists to share information within the international scientific community, by restricting technology from crossing borders in the form of consumer goods, and by making a concerted effort to subsidize private industry by making the fruits of government sponsored scientific research freely available while also pursuing access to the fruits of scientific research conducted elsewhere, the economic benefits that should accrue from increased trade and increased manufacturing activities worldwide are lost in the intricate network of laws and policy conflicts. Ultimately, as advocates of free trade consistently argue, it is the world economy and consumers that pay the price.

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48. 15 U.S.C. § 3710(a)-(d) (1988).

49. 15 U.S.C. §§ 3701-3714 (1988).

50. *See* footnotes 51-55.

51. This was the main thrust of the Stevenson-Wydler Technology Innovation Act, 15 U.S.C. §§ 3701-3714 (1988).

52. FACILITATING ACCESS TO SCIENCE AND TECHNOLOGY, as amended by Exec. Order. No. 12618, Dec. 22, 1987, 52 F.R. 48661.

53. *Id.* at § 4(c).

54. *Id.*

The need to restructure science policy can be justified by four main events: (1) the restructuring of international relations as a direct result of the collapse of the Eastern bloc; (2) the immediacy with which knowledge is often applied today; and (3) the pressure to commercialize scientific data in order to enhance domestic productivity. These factors are heightened by the rise in environmentalism and the consequent demand for scientific procedures which meet specific health and safety standards.[55] Of these four factors, the first stands out as especially significant in the assertion that the existing framework for international transfer of technology must be restructured to facilitate the free flow of information both within and across national boundaries. However, private industry is vigorously opposed to the science ethic of "free flow of information." Citing the rise in international competition, private industry seeks to prevent the flow of information across international boundaries, while increasing its access to research which may be the result of cooperative scientific research across national boundaries. Paradoxically, modern science policy embraces these two desires, i.e., to facilitate private industry access to government sponsored research and to foster the flow of information across national boundaries, that is across foreign boundaries into the United States.

The government's role as policy maker in these potentially conflicting spheres has brought the latent tensions between science policy and technology transfer to the surface.[56] Although national objectives remain unchanged, the control of the flow of scientific data and high technology goods outside of the U.S. for four decades has cost the private industry billions of dollars in the international market. The result is that the impact of recent political changes in international relations has replaced the post-World War Two "consensus" with a frenzied agitation to unravel the conceptual foundations of modern science policy which found its *raison d'etre* in that era. Science policy, which has always lacked a coherent framework, may now limit the immense opportunities this era promises for American industry. This is reflected in goals and objectives embodied in statutes which conflict in their procedural implementation.[57] An interesting example of this conceptual confusion is

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55. NELKIN, *supra* note 41, at 3. *See also* SMITH, *supra* note 1, at 7.

56. As before, only significant changes of a political nature bring about the need to realign domestic needs with international events.

57. A prime example is government policy for disclosure of information derived from science grants and contracts described as a "confused state": ". . . there is a profusion of inconsistent and often conflicting laws, policies ,and practices which have developed over the years to suit specific program purposes or particular interest groups." NELKIN, *supra* note 41, at 6.

the international dimension of science policy, namely the support of scientific efforts abroad carried out in cooperative endeavors.[58] Although the international issues suggest a complexity far beyond the scope of this paper, it is important to state that the promise of a new era in international relations, uncertain yet it may be, provides a viable opportunity to exploit the potentials of international technology transfer.[59] This in turn is only possible if intellectual property laws are rethought within a global framework, for what is eventually distilled from the policy discourse is the fundamental question of ownership of scientific discovery.[60]

While the battle over the international transfer of technology is waged primarily in the context of political sovereignty and hegemony, the internal battle is carried out over the normative proprietability of scientific data.[61] The tributary from this battle is the question of accessibility to information which is an indispensable aspect of transfer of technology , both domestic and international. The question of who owns the technology produced by government-funded research will ultimately determine whether it can be transferred freely across national boundaries.[62] The resolution has both normative and legal implications.

PART II
SCIENCE, TECHNOLOGY AND INTELLECTUAL PROPERTY

Technology as traditionally understood is the fruit of applied science. A more contemporary definition however suggests that technology is the constitutive results of intellectual activity in both basic and applied science.[63] It is the role played by the intellect that results in an object or idea which is protected by law as an intellectual property right. Technology, understood either as applied

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58. Executive Order No. 12591, § 4(a)(1).

59. Even if the legal and structural barriers to technology transfer were removed, there still remains the larger, more significant question of local innovation in the recipient countries. The history of U.S. science policy suggests that there was a time when the American public believed that the nation could import scientific ideas from Europe just as it did capital. Indeed, prior to World War II, American firms used technologies that were borrowed, and product designs that were derivative, and originals that were usually imitations from Europe.

60. NELKIN, *supra* note 41, at 5. Scientists seem uncomfortable with the idea of scientific research as "property."

61. *Id. See also* GROVE, *supra* note 22, at 55.

62. Strictly speaking, the Federal Government cannot "own" technology; however, the Stevenson Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Technology Act targeted this issue and mandated the transfer of data from government laboratories to private industry.

63. Certainly statutes regulating technology make no big distinction between the fruits of applied versus basic research.

science or as the result of basic and applied science expressed in a new and useful idea, process, or practical working tool, is the product of intellectual activity. For as long as intellectual property laws create rights which attach to the results of intellectual activity, science and technology will remain an integral part of intellectual property law. As such, the transfer of technology is literally the transfer of an idea, process or working tool, as well as the rights which give it its proprietary nature.

The idea of increasing public welfare was the main ideological justification for the intellectual property system[64] as conceived by the Founding Fathers.[65] Thus, although the Founders were reticent about the monopoly feature of the European Patent systems already in place, the thought that "ingenuity should receive liberal encouragement" had strong appeal to them.[66] The ensuing American version of granting rights in intellectual goods was an uneasy compromise between the desire to induce new knowledge by rewarding the inventor[67] and the inherent conflict with freedom of thought which such a monopoly grant created. The conflict was attenuated by the stipulation that only inventions or discoveries which furthered public welfare would receive the monopoly grant.[68] Today, technology, as a subject of intellectual property laws, is a private good, bought and sold in the marketplace and subject to the market forces of supply and demand.

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64. NELKIN, *supra* note 41. The same ideology gave legitimacy to the economic justification of the intellectual property system. *See* note 4 and accompanying text.

65. U.S. CONST. art. 1 § 8, is the enabling clause behind the intellectual property system. Thomas Jefferson, himself a scientist, examined all patent applications personally under the first Patent Act. 17 ENCYCLOPEDIA BRITANNICA 370.

66. This appeal was, however, not without problems for the Founders. Jefferson, for example, struggled with the economic inefficiency of a monopoly system:

> [I]t is the action of thinking power called an idea which an individual may exclusively possess as long as he keeps it to himself; but the moment it is divulged, it forces itself into the possession of everyone . . . Its peculiar character too, is that no one possesses the less, because every other possesses the whole of it. He who receives an idea from me receives instruction without lessening mine: as he who lights his taper at mine, receives light without darkening me . . ..

Nance, *supra* note 26, at 762.

67. The first judicial affirmation of patents for inventions provides:

> But if a man hath brought in a new invention and a new trade within the kingdom in peril of his life and consumption of his estate or stock . . . or if a man hath made a new discovery of anything, in such cases the king of his grace and favor in recompense of his costs and travail may grant by charity unto him that he shall only use such a trade or trafique for a certain time because at first the people of the kingdom are ignorant and have not the knowledge or skill to use it.

Clothworkers of Ipswich, *citing* Earl of Kents Case, 21 Edw. 3, 47 (1615).

68. The statutory embodiment of this objective is the "new and useful" standard of U.S. patent law. *See* 15 U.S.C. § 101 (1988).

A. The Transfer of Technology

Legal thought has recently been synthesized with political theory and other social science disciplines in an attempt to unravel the values which inhere in "law" as articulated by government, courts and judges. Under this multi-disciplinary spotlight, law not only regulates social structure, but defines and reinforces it in accordance with specific values. As such, the language and meaning of the law has been subject to rigorous scrutiny by critical legal scholarship.[69]

Of particular significance for the analysis here is the role of law as an inherent bearer of inequality manifested through language.[70] Adopting this analysis with regards to the intellectual property system, it should fisrt be observed that no standard definition of the process of the transfer of technology exists. This is true for both domestic and international transfer processes. What exists instead is a host of ideological expressions of what the process consists of, or is about. The search for an acceptable definition remains fruitless because technology in the international market is clearly identified as an economic and political commodity.[71] Its movement across national (or even within national) boundaries implies a loss of power, even though there is the exchange for economic value in the price paid for the technology.

In the international context, the result is an attempt to distort the real costs of technology transfer by a sophisticated interpretation of the process. Thus one scholar, for example, has defined technology transfer as:

> [A] process which at the users' end includes understanding and acceptance of concept, requirements of related knowledge, time to convert knowledge during training, and change of attitudes into skill and initiatives to make experiments and getting experience.[72]

Another definition describes the transfer of technology simply as

> [T]he transfer or exchange from advanced to developing countries of the element of technical know-how which is normally existent in very short supply or totally absent in developing economies.[73]

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69. *See, e.g.*, David Kennedy, *The Turn to Interpretation*, 58 S. CAL. L. REV. 251 (1985).

70. *Id.* at 251-252.

71. This is more readily seen in export control legislation, particularly the control of "dual-use" technology. Dual use technology has both commercial and potential military use. *See* Export Administration Act of 1979, as amended by the Export Administration Act of 1982, as amended by the Export Administration Act of 1985, amended by the Omnibus Trade and Competitiveness Act of 1988. This last Act expired in 1990.

72. KLINTOE, World Intellectual Property Organization/ST/CA16, (1978).

73. DENES GOULET, THE UNCERTAIN PROMISE: VALUE CONFLICTS IN TECHNOLOGY TRANSFER 51 (1977).

Neither of these definitions wholly reflect the constitutive elements of technology transfer. Neither, for example, mention the release of the legal rights which define and determine what is being transferred. Some attempts at defining the process have emphasized utility, others the practical element of know-how, and still others the end result of increasing scientific knowledge and contributing to the industrial base of the country. The latter two features are dominant in the domestic transfer of technology policies.[74] All focus on the object, i.e., technology, and its normative qualities rather than on its transfer*ability*, which is defined by intellectual property law operating within the requirements of national policy.

What does stand out as central in the language of various definitional attempts is that the desired result of technology movements across national boundaries is to ensure that [developing] countries have *access* to technology not developed by them.[75] This objective is restated and amplified by U.N. General Assembly Resolution 3507 (xxx) and 31/83 (xxi) in the 1972 Declaration of A New International Economic Order. It states, *inter alia*,

> The ... order should be founded on ... the following principles: *giving* ... [developing] countries *access* to the achievements of modern science and technology, and promoting the transfer of technology ...[76]

The World Intellectual Property Organization (WIPO) restates the objective of the resolution as follows:

> The objective ... is to develop and promote the flow of technological information with a view to ensuring that, that which is immediately relevant to development, reaches those directly responsible for the acquisition and application of technology in developing countries, ... that the said information is transmitted in a complete and ... usable form.[77]

Although this was a policy objective, the features of emphasis highlight the salient elements necessary for international technology transfer, viz: (1) access to scientific information, and (2) promoting the flow of technical data to enhance the industrial and scientific

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74. 15 U.S.C. §§ 3701-3714 (1988).

75. In other words, through the process of technology transfer, the underdeveloped countries "began an attempt to industrialization without the benefits or costs of the long ... evolutionary process of technological change that had taken place in the western nations." OSITA EZE, THE TRANSFER OF TECHNOLOGY TO DEVELOPING COUNTRIES (1986).

76. U.N. GAOR, Ad Hoc Committee, 6th Spec. Sess., Resolution No. 3201 (S-VI (May 1, 1974), *reprinted in* DJONOVICH, U. N. RESOLUTIONS SERIES 1 GENERAL ASSEMBLY, Vol. XIV (1972-74) at 528. (Emphasis added).

77. KLINTOE, *supra* note 73.

base of developing countries. Thus, the purpose of international technology transfer is to make the fruits of scientific research accessible to countries to enhance the scientific base of these countries with the ultimate objective of increasing their industrial capacity for the production of goods and services. Neither of these factors are feasible however, unless the "rights" inherent in technology are relinquished, or at least reconstructed.

In a market economy, the transfer of proprietary rights is mainly governed by private negotiations with statutory or policy restraints left to a bare minimum.[78] In consonance with the principle of market efficiency, it is assumed that in the context of private arrangements recognized and enforced by law, private parties will bargain in a way that directs the useful allocation of resources, as well as being mutually beneficial so that ultimately society as a whole is better for the arrangement.

The legal connotation of the term "transfer" in relation to the proprietary interests which attach to private property, denotes the release of those rights to another, either wholly or as regulated by law,[79] policy, or private (contractual) agreement. Because intellectual property rights are kin to the rights attributable to real property, the same assumption can be made about their transfer, i.e., they will be beneficial to all the parties and ultimately the larger society. The larger society with regards to international transfer would refer to the international economic base. Certainly this assumption and the legal meaning of "transfer" is employed in the context of domestic transfer of technology policy.[80] The international context, however, is prone predictably to divergent practices based on political and foreign policy concerns.

International intellectual property issues often reflect the larger socio-political fractures in the larger international community. Ranging from the articulation of science in law as intellectual property, to the embodiment of intellectual property rights in technology, the commercialization of science is "integrally linked with power and profit."[81] As such, the root problems, indicative as they are of power relations, have largely remained unsolved, and the laws resistant to change in a way deemed equitable by the weaker members of the international community. The rhetoric is only more forceful as trade

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78. These, predictably, are military secrets, national security issues, or more recently, environmental standards.

79. One example is the doctrine of takings.

80. The Stevenson-Wydler Act allows the government to assign its rights from the fruits of government funded research over to small businesses. *See* 15 U.S.C. § 3710(a) (1988).

81. NELKIN, *supra* note 41, at 4.

and politics have institutionally converged under the formal auspices of the General Agreement on Tariffs and Trade.[82] As such, technology transfer takes on diverse, but infinitely significant, meaning when the relationship is played out between unequal bargaining powers in the larger framework of global competition.[83]

The international transfer of technology should be understood as a process which ends in the *acquisition* of scientific and technological research developed in one country by another country. In other words, the rights as well as their object should be the subject of the transfer.

One of the criticisms levelled against the attempt to transfer technology from the government to the private industry is that "transfer" is not possible where the rights which normally attach to intellectual property are not acquired by the transferee.[84] Accessibility to technology does not necessarily give rise to the right to utilize it for production or further development without the outright grant of the right, or permission by the owner. In the same way, while access to technology is crucial for the successful international transfer of technology to take place, it is insufficient where the ultimate purpose of the transfer is to use it to expand a countries technological base.

Currently accepted visions of international technology transfer, dependent on the independently perceived definitions of the phenomena of technology transfer described above, leaves unfulfilled its promise as a tool for greater productivity and new wealth for those countries dependent on external technologies. However, to understand fully the importance of technology transfer for the production of goods in less developed countries and the nature of underdevelopment in its technological context, it is necessary to understand something of the economic history of North/South relations.[85]

B. Technology and North/South Economic Relations

When the wave of independence swept over much of what today is known as the Third World, roles in the world market had already

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82. *Id.*

83. *Id.*

84. Chandler James, *Protection of U.S. Competitiveness in the International Software Markets: Reexamining the Question of Copyrighting Government Created Software*, 25(2) GEO. WASH. J. INT'L L. & ECON. 387, 399 (1991).

85. For a detailed analysis of North-South economic relations, *see* L.S. STAVRIANOS, GLOBAL RIFT: THIRD WORLD COMES OF AGE (1981); AKIN L. MABOGUNJE, THE DEVELOPMENT PROCESS: A SPATIAL PERSPECTIVE (1980).

been defined. Ex-colonies, as new political actors in the international community, automatically continued in their role as producers of raw materials and purchasers of industrialized goods.[86] It is this latter aspect of the structure of international economic relations that has, in the past four decades, come to bear significantly on the perennial question of development in the Third World.

When the industrial revolution swept throughout the Western world in the nineteenth century, the colonies of Europe were naturally not participants in the phenomena that later was exported to the United States.[87] With the fruit of the revolution fully evident in western nations by the twentieth century, international progress came to be defined along industrial grounds and the ability to absorb and develop technology.[88] Armed with economic justification, and combined with government policy generated from constitutional mandate,[89] the system of intellectual property protection as we know it today was reinforced in the West and extended to countries in the South as part of the colonial process.

With the onset of the Cold War in the twentieth century, the technological race began in earnest as ideologies struggled for the minds and economies of the rest of the world. Directly connected to the Cold War, and, in a sense, inextricably caught in the socio-economic dynamics of the era, the non-aligned countries of Africa in particular, and the smaller countries of the world in general, became recipients of military technology from the superpowers. However, as this was primarily finished technology, it had no significant impact on the domestic economies of the transferee countries in terms of their own scientific capability.[90]

When the debt crises erupted in the early 1980's, it became clear to the world that these countries were not able to pull themselves out of the cycle of debt and what became popularly known as the phenomena of "under-development."[91] Technology as a key to

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86. *Id.*

87. To the contrary, historians identify the nineteenth century as the watershed of the colonial experiment, particularly in Africa with the Berlin Conference of 1884. The industrial revolution came to the United States in 1790. *See* SMITH, *supra* note 1, at 23.

88. GOULET, *supra* note 73, at 16: "[S]cientific and technical information is the lifeblood of progress...."

89. "Congress shall have power to pass laws to promote the progress of science and useful arts...". U.S. CONST. art. 1, § 8, cl. 8.

90. Though there are some who would contend that finished goods are inherent bearers of technological data, the fact that the system prohibits the copying of the technology coupled with the fact that these countries lack the know how and industrial base to apply technology, the availability of finished goods cannot be said to have a measurable effect on a nation's technological capability.

91. Under-development is used to denote the condition of intolerable socio-economic conditions pervasive in the countries of the Southern hemisphere. The term "Third World"

engendering new wealth became a putative savior of the Third World, under the aegis of the United Nations and its various specialized agencies.[92] Technology, either as "systematic knowledge for the manufacturing of a process," or as "all elements of productive knowledge needed to transform inputs into products," was needed to expand and improve the ability of a populace to utilize and control the natural and social forces surrounding them. Technology was "the life-blood of progress" which poorer countries of the South so desperately needed. Hence the need for the international transfer of technology, to make useful knowledge available to poorer countries for their development and economic progress. However, the gap between the West and the less developed countries seemed to increase exponentially in spite of the work of institutional agencies such as the Group of 77, and the efforts of U.N. specialized agencies. Reasons for this can be traced to the "nationalization" of science which occurred in the West during the cold war, which impeded the flow of useful scientific information to these countries in the past. The international impact of major intellectual property systems also militated against the transfer of technology by fostering market monopolization through the nature and length of the monopoly rights attendant to the intellectual property rights. And just recently, what residual remains of the prospects of international technology transfer is threatened by the convergence of trade, politics and policy in the international sphere of market relations regulated by the GATT.

It is interesting that in the recent wake of U.S. economic leadership being threatened from the Pacific by Japan and other Newly Industrialized Countries (NIC's), and from the West by Europe, concern about American economic leadership in the future has been voiced from all quarters. For the first time in history perhaps, the U.S. has begun to experience and voice concerns hitherto only expressed by Third World countries. The situation has brought forth the admission that

> If U.S. competitiveness were to erode to the point of economic dependence on a foreign nation, the national security and *freedom* of the United States could become impaired.[93]

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became synonymous with under-developed economies. Certain development writings recently resurrected suggest the community principle in regard to intellectual property, i.e., that science and technology are the common heritage of mankind. This perspective has particular appeal with respect to drugs and other essential goods.

92. *See* note 76, *supra*.

93. Chandler, *supra* note 84 (emphasis added).

The international transfer of technology is a process full of promise for the productive capacity of all countries, in particular the emerging nations of the Eastern bloc. From the independence era of the Third world, and more recently the Baltic states, the search for technology is a priority in national policy. This is not an anomaly; indeed, technology had long been recognized as the single most important resource needed to create other resources.[94] But for these countries without the benefit of technological evolution, technology and freedom converge in the rhetoric of intellectual property and technology transfer, technological dependence on the West and is still recognized as the most critical aspect of the dependency relationship.[95] With the vast sums of capital being funnelled to the Eastern block through private investment and foreign aid, the economic stability and political future seems promising. But without the technological foundation for production and manufacture, without the opportunity to cultivate domestic scientific and innovative progress, the long-term future of these newly-independent countries is at best, an uncertain promise.

E. The Problem of Technological Dependence

The phenomena of dependence in the context of international relations is one which continues to attract attention from political scientists and international law scholars. The problem of dependence in the context of technology transfer, however, is perceived as a cause, symptom, and effect of the general dependency relationship.[96] As such the issue of the transfer of technology inherently reflects the external value conflicts between the North and South.

The importance of the dependency question lies less in the ideological rhetoric of underdevelopment, than in its actual exhibition in all spheres of national life—ranging from political and legal institutions to cultural and social organizations. As one scholar says of Third World social culture:

> [O]urs is essentially a consumer society that strives to catch up with the latest in industrialized states . . . We seem to have inherited all the weaknesses of the capitalist system without acquiring its discipline.[97]

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94. U Thant, Inaugural Address, *United Nations Second Development Decade* (1970), in GOULET, *supra* note 73, at 7.

95. FRANCIS STEWART, TECHNOLOGY AND DEVELOPMENT (1980).

96. *Id.*

97. Osita Eze, *Import Substitution and Technology Development*, NIGERIAN J. POL'Y & STRAT. STUD. 67 (1986).

The United Nations Center for Trade and Development confirms this observation, maintaining that

> It would be surprising if there did not exist a minority in developing societies that stand to derive major benefits from a continuation of the status quo. Since this minority typically exercises most of the decision-making power, the type of comprehensive policies needed to strengthen technological capacity can only be conceived and implemented within the broader context of far-reaching changes in social, political, economic, (and legal) structures of these countries.[98]

However, where countries have made changes in their intellectual property laws perceived to be in their national interests, the United States has vigorously opposed them.[99]

Technological dependence is said to arise where a disproportionate amount of a country's technological resources come from outside the country. It is, however, doubtful that this is a correct analysis. The vital feature of technological dependency ought to be presented in terms of technological innovation arising from within the country as opposed to that which is in its possession. This is so because the question of technological advancement lies jointly in the creation of the idea, its utility to society, and, ultimately, its crystallization as a tangible or finished product which aids the production of goods and services. This is the standard utilized both in the justification of a monopoly award system such as patents and other intellectual property rights. It is also the measure of whether or not an invention qualifies for such an award in the first place.[100] It has long been recognized that the importation of technology or its transfer cannot alone, constitute a nations industrial base. Domestic innovation is invaluable for real industrial progress and economic advancement. However, it is increasingly being suggested that the very nature of intellectual property protection in the international context, coupled with the sheer force of globalization will work to prevent innovative activity in less developed countries from becoming a vital transforming agent of the industrial capacity of these countries.

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98. *Id.*

99. Sec. 301 of the 1974 Trade Act and its variations such as "Special 301," has been used to oppose intellectual property practices in countries where the U.S. finds that these practices are detrimental to U.S. interests. Although § 301 was aimed primarily at counterfeiting, piracy and infringement of intellectual property rights, practices deemed "unfair," § 301 has also been used as a leverage to force countries to adopt intellectual property laws that conform to U.S. practice.

100. 35 U.S.C. § 101 (1985).

PART III
THE DOMESTIC TRANSFER OF TECHNOLOGY

Taken outside the context of international relations, the transfer of technology has a much more potent and socially justifiable appeal. The domestic transfer of technology is, however, as burdened as its international counterpart, so that even where the process is deemed "successful," its effects are not widely felt in the macroeconomic sphere.

The domestic transfer of technology would optimally take place in one of three ways: (1) the movement of technology between firms; (2) the movement of technology within firms; and (3) the movement of technology across industry boundaries.[101] With heightened global competition, suggestions have been made to increase the flow of technology from public domain to private industry.[102] This would constitute a fourth mode of transfer. The objective of this last form of technology transfer, as embodied in statute, is to "transfer technologies out of national laboratories into private industry." This objective was to be met through two significant pieces of legislation, the Bayh-Dole Patent and Trademark Amendments of 1980 and 1984,[103] and the Federal Technology Transfer Act of 1986.[104]

The Federal Technology Transfer Act does not provide a definition of technology transfer. However, a working definition can be constructed from the provisions of the National Technical Information Service,[105] established under the Department of Commerce and Technology Administration.[106] Section 3710(d)(1) provides that the service shall "serve as a central clearinghouse for the collection, dissemination and transfer of information on federally owned or originated technologies having potential application . . . to private industry."[107] Of significant import is section 3701(10):

> Congress declares that . . . Federal laboratories and other performers of federally funded research and development frequently provide scientific and technological developments of potential use to . . . private industry.[108]

In addition to the explicit objectives of transferring technology from the "public" sector to private industry, Congress also stipulated

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101. 15 U.S.C. § 3710 (1988).
102. Stevenson-Wydler Technology Innovation Act 1980, 15 U.S.C. §§ 3701-3714 (1988).
103. 35 U.S.C. §§ 200-211 (1988).
104. 15 U.S.C. § 3710(a)-3710(d) (1988).
105. 15 U.S.C. § 3707(b), 3710(d) (1988).
106. 15 U.S.C. § 3704(a) (1988).
107. 15 U.S.C. § 3710(d)(1) (1988).
108. 15 U.S.C. § 3701(10) (1988).

that the Assistant Secretary of Commerce for Technology Policy[109] as part of his legislative duty, was to seek ways to exploit innovations of a *foreign* origin.[110]

The notion of competition and its validation as a desirable value in a market economy had long prevented the transfer of commoditized technology to be perceived as a feasible goal in domestic policy on science and technology.[111] This theoretical policy barrier carried with it traditional notions of private sector independence from unnecessary governmental intervention or subsidization. The intricate framework of laws regulating technology has only recently[112] begun to focus on domestic technology transfer. The flow of technology within national boundaries would, as stated earlier, optimally take place inter-firm, intra-firm and across industry boundaries. For the effective transfer of technology to take place in the first (i.e., inter-firm), however, macroeconomic considerations involving corporate organization will have to be restructured. A popular practice within multinationals, for example, is that of inter-firm competition, whereby units in a single corporation compete as though they were in the market place. Under such a framework company policy would prohibit the sharing of information or technical assistance across these units. The overall goal is maximized returns through greater efficiency in individual units motivated by a financial incentive from the managerial level. In such a company, the transfer of technology from unit to unit would be prohibited.

While this might benefit a firm short term in a purely micro-economic sense, the overall costs in the long run to society which should ideally reap the returns of investments through cheaper, better-quality goods, would not take place. For the firm, the possibility of duplicated technology and the costs in labor and skill will also prove, in the long term, to be inefficient as costs override profits and returns increasingly depreciate against the rate of investment.

This paradigm, which is generally accepted in the corporate economy ultimately leads to a fragmentation of the overall economic policy objectives as a result of its gross macroeconomic inefficiencies. While the system allows for a sophisticatedly efficient managerial pool, the idolization of the role of competition depresses the

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109. 15 U.S.C. § 3704(b)(2) (1988).

110. 15 U.S.C. § 3704(c)(14) (1988).

111. 15 U.S.C. § 3701 (1988).

112. The first Act with the specific purpose of encouraging technology transfer was the Bayh-Dole Patent and Trademark Amendments of 1980 and 1984, which was followed by the Stevenson-Wydler Act of 1980. *See supra*, notes 103-104.

incentives for long-term vision and discourages the real participation of the private sector in the realization of domestic economic goals.

If this is the situation within firms, it is not difficult to conceive the ideology which influences intra-firm technology transfer. The transfer of technology inter-firm would mean "selling out" to the competition, a loss of market share, and some would argue, leave no incentive for specialization while risking efficiency.[113] Thus the transfer of technology from the public sector to private industry becomes the most probable and championed mode of domestic technology transfer.

The interrelationship of several statutes constitute the framework for the transfer of technology from public sector to private industry. Some of the statutes facilitate, and in some cases mandate, the flow of technical information through the movement and exchange of scientists, through the publication of journals and bibliographies, through conferences and seminars sponsored by the Federal Government, and by disseminating the results of international cooperative efforts to the private industry.[114] Legislative guidelines also established research consortiums and authorize the cooperation of government scientists with private industry in order to help private industry maintain its competitive edge in international commerce. Finally, legislation also allows the transfer of Federal intellectual property rights to the private sector.[115]

In defining the success of technology transfer domestically, several key features are: (i) the accessibility of the technology; (ii) the availability of the know-how; and (iii) the utility of the technology to the production of goods and services. These features combined make room for specialization, decreases in cost of production, and a more efficient allocation of capital resources for further innovation. Thus, in looking at transfer of technology domestically, it is clear that absolute advantage allows the possibility of resource organization. It is possible that if firms are provided with proper incentives to transfer technology, or if they are deregulated and restructured in such a way as to make technology transfer a necessary good, the utility of technology in industry will be heightened to its maximum potential, thereby opening room for further development of the technology for specific goods intrafirm. This in turn will further allow for adaptability to specialized firms and, ultimately, yield a

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113. Despite the obvious perceptions about the value and success of interfirm transfer of technology *viz a viz* its intra-firm counterpart, studies indicate that the costs and losses in both cases remain the same, both in the macroeconomic and microeconomic sphere.

114. *See supra* notes 103-104.

115. *See supra* notes 106-112.

higher rate of return for society in the form of cheaper goods and services.

At this point, I would like to analyze the differences between the domestic transfer of technology and the international transfer of technology. First, the policy governing the domestic transfer of technology is clear in its goals and objectives, unlike its international counterpart. Second, the theory of absolute advantage which structures domestic trade allows for the absolute guarantee of returns to the government, so that technology transfer, which flows with investment, is a desirable phenomena among domestic economic managers. Third, the socio-economic structure of domestic economy and its maturation since the mid-nineteenth century has prepared society for the absorption of technology. This invariably means that the adaptability of technology is possible and in fact necessary to achieve optimum returns from the process of technology transfer. Finally, the idea of private property which is necessary to ensure respect for property rights is a highly developed legal phenomena in our capitalistic democracy. These four factors combined mean that domestic structural imbalances, such as an economic recession for example, will not have as significant an impact on the technological capacity of the nation; neither will it create a domestic counterfeit market such as those which exist in many developing nations. It is clear from current legislation, that government policy is eager to promote the transfer of technology across industries as well as within firms and other social units.

One of the clearest indicators of the difference in international transfer of technology and the domestic counterpart is the conciseness of the rhetoric which governs the latter. Domestic transfer of technology is defined by political and economic objectives, regulated by science policy, in tune with economic and political agendas. The objectives of the process is clearly articulated, statutes state the multiplicity of ways the transfer may take place and identifies specific institutions, offices and individuals to be responsible for the success of technology transfer.[116]

The stated objective of increasing the domestic transfer of technology is to "increase the international competitiveness of U.S. industry by transferring important and valuable technology out of national laboratories and into private industry."[117] The purpose of

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116. *Supra, see* text accompanying notes 106-112.

117. 15 U.S.C. § 3710 (1988). It is interesting to note that neither the technology policy nor the transfer of technology policy reflect any significant relationship to science policy. This is part of the root problem, the `conceptual confusion' which makes it difficult to separate science

the technology policy on the other hand is to "enhance the scientific knowledge of the nation . . .."[118] It is thus a matter of law to transfer technology defined as "providing information such as advice, technical assistance, and reports" as well as through the interchange of laboratory personnel.[119] Transfer is defined primarily as accessibility to . . . technology for the development of new products and processes.[120] This is fully congruous with the national science policy which has as its purpose the "enhance(ment) of the scientific knowledge of the nation."[121]

The domestic transfer of technology from "public" domain to private industry is thus limited by statute only to "U.S. business and industry." Thus even domestically, efforts to deny non-U.S. businesses, and citizens access to "public" scientific data are part of science policy. Consequently, what occurs in the international process is the "flow"[122] of technology as distinct from the "transfer" of technology as argued earlier. This reflects the practical external impact of science policy, and consequently, Third World dissatisfaction with the current regime of intellectual property laws.

The argument that "[f]ailure to protect U.S. intellectual property assets . . . could result in the transfer of these assets to foreign economic competitors . . . [and] injur[e] the ability of U.S. industry to compete in international markets"[123] is one which reflects the power of the exclusive nature of intellectual property rights in the global market. If the technology were freely available to both domestic and foreign industry, only monopoly, not true international competition would be injured.

Also, it has been noted that technology transfer has significance to industrial innovation; that is, having it accessible allows it to be developed and applied productively. The case for domestic transfer of technology diverges from its international counterpart ultimately because the latter is primarily built on a theory of exclusivity, and the former on the theory of dissemination.

Given the socio-economic impact of intellectual property, it is easy to see where the domestic transfer of technology, and the

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and technology from the wider social ends to which they are but means. SMITH, *supra* note 1, at 1.

118. Chandler, *supra* note 84, at 392.

119. *See* 15 U.S.C. § 3710 (1988).

120. *See* Executive Order No. 12591, as amended by Executive Order No. 12618, Dec. 22, 1987, 52 F.R. 48661.

121. *See* Chandler, *supra* note 84, at 392.

122. The distinction between the "flow" or "circulation" of technology, distinct from the "transfer" of technology is critical to the position of the Third World with respect to the impact of the intellectual property system. *See* GOULET, *supra* note 73, at 51.

123. Chandler, *supra* note 84, at 402.

international transfer of technology must diverge in both policy and practical (legal) terms. On a microeconomic level, the closest domestic analogy to the socio-economic dimensions of international transfer of technology is the intra-firm process which involves participants in a market striving for mastery over the same product in a single market. Taking this basic scenario outside of domestic borders one encounters a myriad of socio-economic forces unleashed in the framework of international relations. These relations and their articulation in international treaties and other economic agreements, to a large extent predetermine the market share of individual countries.

PART IV
LEGAL ARRANGEMENTS FOR THE INTERNATIONAL TRANSFER OF TECHNOLOGY

Several arrangements exist to facilitate the flow of technology, across national boundaries, the vast majority of which revolve around a contractual agreement. The distinctions in the form of these arrangements are purely formal—ranging from the duration of the right, to the nature of obligations incurred by the contracting parties. Licensing, for example, simply allows the use of technology; joint ventures typically provide technology required in the undertaken of a joint project; turn-key contracts involve the building of an entire industrial plant and giving the "key" (i.e., know-how necessary to operate the plant) to local personnel. In none of these traditional modes of "transfer," however, are the absolute rights of ownership exchanged. Further, only in licensing arrangements can one plausibly say that access to technology has been given.[124]

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124. The common agreement among Third World scholars has been that the form of joint ventures are the best means to ensure that technology is transferred. However in the conceptualization of the objective of technology transfer, both in its domestic and international articulation, it is clear that only licensing really gives access to technology, the opportunity to utilize it for foreign domestic purposes, and the opportunity to adapt it to suit peculiar needs. One crucial drawback of this form of accessibility, however, is the fact that licensing agreements usually require that any new technology derived as result of the technology licensed belongs to the licensor. As result, no reward goes to the developer of the new technology, no revenue accrues to the government of the host country, and the technical base of the country cannot be said to have been enlarged by the new discovery which, in essence, does not belong to them. For a detailed analysis of the impact of international licensing agreements on host country technical base, *see* Goulet, *supra* note 73, at 53; Raimo Vayrynen, *International Patent System*, TRANSNATIONAL CORPORATIONS AND TECHNOLOGICAL DOMINANCE (1976); CONTROLLING INTERNATIONAL TECHNOLOGY TRANSFER: ISSUES, PERSPECTIVES AND POLICY IMPLICATIONS (Tagi Sagafi *et al.*, eds., 1986).

Within the domestic framework, however, the legal arrangement *determines* the nature of the rights which move from one party to another.[125]

Other legal arrangements include production line agreements, consultancy agreements, the exchange of skilled personnel, and know-how contracts.[126] The latter two provide the necessary practical skills necessary to utilize the technology, and, indeed, the personnel may themselves embody some technological resource.[127] Within the context of domestic transfer of technology, however, only a few of these methods are recognized as successful means of facilitating the transfer of technology. Examples include licensing, advice, exchange of personnel, and assignment of intellectual property rights. While these methods may be successful in the domestic setting, the same cannot be said for the international context.

Licensing often does not involve "complete" information—it usually applies to a piece of technology which constitutes a larger technical project or process in the buying country. Joint ventures on the other hand are "complete" in the sense that an industrial project is established, capable of employing personnel and being used in the production of goods and services. However, the manner in which joint-ventures are structured in the Third World blocks local partners from exposure to technical know-how which is necessary if the scientific knowledge and the technical capacity of the host country will be enhanced.[128] Thus technology transfer, in its legal or conceptual articulation, is not achieved by any of these modes. Also, the macroeconomic utility of whatever technology does trickle down to local scientists is doubtful. Finally and most importantly, the intellectual property rights which determine whether or not a transfer in the legal sense has occurred, are left in the proprietorship of the purported transferor throughout the duration of the

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125. A contract, for example, allows the government more control than say, a grant or a cooperative assignment. This is especially so when the grant goes to a non-government scientist. *See* NELKIN, *supra* note 41, at 5.

126. The domestic transfer of technology also utilizes these means of transfer. *See also* 15 U.S.C. § 1152(b), which enumerates other means of transfer. These include "the preparation of abstracts, digests,translations, bibliographies, indexes, and microfilms." *See also* 15 U.S.C. § 3704, which establishes the Department of Commerce a[nd] Technology Administration under which the National Technical Information Service was created. The function of the Service is to serve as a clearinghouse which "may disseminate information through reports, directories, handbooks, conferences, and seminars."

127. *See* WIPO/ST/CA16: "[N]othing is so effective a carrier for the transfer of knowledge than a qualified human being."

128. Thus the element of know-how is also an indispensable element in the process of technology transfer. This is also true of domestic technology transfer. *See generally* 15 U.S.C § 3710 (1988), specifically (c)(4), (d)(3)(5).

contractual relationship. What occurs in essence through these contracts is the "circulation" or "flow" of technology, but certainly not technology "transfer."

Another feature of the legal framework for the transfer of technology is the issue of export control for national security concerns. This much debated subject has diminished in significance as a result of the end of the Cold War. However, it is still worth noting because of its impact on the international flow of technology in the world market.

Under the Export Administration Act of 1979,[129] commodities and technical data exported from the U.S. required specific governmental permission.[130] Although the primary target of the Export Control laws were the Eastern block countries and the former U.S.S.R., the impact was felt in many Third World nations. The lack of technical data available in specific industries in these countries bears significant relation to Export Control regulations.[131]

It is necessary if technology flows are to be worthwhile investments for Third World countries, that the conceptualization of technology transfer focus on accessibility, minimally defined as exposure to technology through use and application on specific enterprises, or through training, or both. In the discourse on the domestic transfer of technology, the issue of accessibility has been considered so essential as to generate an Executive Order[132] just for the purpose of enhancing accessibility to technology. Again, if there is no access to technology there can be no transfer, local or domestic. Technology remains in the same hands.

While the burden for technological utility and development to suit local needs is the responsibility of the the foreign country, it should be recalled that the primary function of the intellectual property system is the dissemination of information. Indeed, intellectual activity qualifying for protection under the system may be denied such right if the idea or tool is not revealed to the public.[133] To justify an international intellectual property system which guarantees monopoly rights held against the world at large, dissemination for public welfare interpreted in the international context must be a

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129. 50 U.S.C. § 2404 (1988). *See also* §§ 2405-2406.

130. 50 U.S.C. § 2404 (1988).

131. The 102nd Congress adjourned without taking up the Export Administration Act (HR 3489) which would have reauthourized the expired act which lapsed two years ago. It is expected that the EAA will be taken up by the 103rd Congress. INT'L TRADE REPORTER (BNA), Nov. 11th, 1992.

132. Executive Order 12591, Facilitating Access to Science and Technology, April 10, 1987, 52 F.R. 13414 as amended by Executive Order No. 12618, Dec. 22, 1987, 52 F.R. 48661.

133. *See supra* note 12.

foundational norm. When a grant of a monopoly becomes an end of the system in itself, it defeats the purpose of the intellectual property system.

PART IV
CONCLUSIONS

As technology became synonymous with power, and as new wealth transformed the face of the industrial world, the international community, operating within the framework of international organizations, began to turn its attention to the development of a technological base as the key to development in the Third World. This focus sharpened with the eruption of the debt crises in the early 1980's as it became clear that technological advance in the West increasingly widened the disparities in the socio-economic conditions of life in these countries. As the world market became increasingly depressed, the poorer nations of the world were the first to feel the impact as capital inflow through foreign investment trickled to a stop. Clearly, the costs of the international transfer of technology carry significant implications for the international community. It is also clear that these costs are calculated and weighed more by their political implications than by their economic or social benefits to the larger international market community. The structure of the international political and economic regime is certainly in a state of flux, but in the new era of international relations, the stakes have become more clearly articulated as economies all over the world struggle for positions of dominance in the world market.

For the most part the question of technological innovation in the Third world has not yet been addressed either as a function of the existing international intellectual property regime nor as a question of what the future holds in terms of technological advancement, and consequently, competitive ability and economic growth and for the Third World. Western scholars have always maintained a standard position. This position can be summed up in two sentences: The Third World is stealing U.S. intellectual property and infringing on their rights through counterfeiting; The Third World has much to benefit in real terms because intellectual property protection is mutually beneficial for both the owner and the protector of the property.[134] The articulated justification for this position outlines,

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134. M. Buljic, *International Protection of Intellectual Property and Foreign Investment, in* FOREIGN INVESTMENT IN THE PRESENT AND A NEW INTERNATIONAL ECONOMIC ORDER (DICKE, ed., 1987) at 52.

ironically, among other things, the possibility of technology transfer to a country which protects intellectual property.[135] This simple proposition belies the complexity of the problem and the multiplicity of factors that must be accounted for in determining the viability of the intellectual property system in an international context.[136]

From the analysis in the preceding sections, it is clearly erroneous to imply that technology transfer is not dependent, both on the system of intellectual property and the effects of science and economic policy. As Third World scholars have consistently argued, the system operates in such a way as to *prevent* the transfer of technology. This reality for many underdeveloped countries is validated by the fact that the aggregate of intellectual property rights is held by foreigners, who then, by virtue of the monopolistic nature of intellectual property, consolidate a market share in goods for the seventeen-year period of the patent or the lifetime plus 50 years of the copyright. As a result, the international impact of the system for the protection of intellectual property law has been identified as a dominant force in the underdevelopment process.[137]

Scholarship from the South has also remained traditionally fixed on the same response to the western position. These positions are often clothed in the rhetoric of oppression and neo-colonialism, inferring in some instances that science and technology is the common heritage of humanity, and that the Third World should be "given" technology. The clearly erroneous assumptions of this position, as well as, its ideological conflict with the system of private property which established a political and legal base for the intellectual property system cannot be examined here. Suffice it to observe that this position also has not fully addressed the questions raised earlier, namely, the impact of the current international regime on domestic innovative capability and the possible alternatives for technological progress in the Third World.

In the global marketplace, technology prices reflect the monopoly feature which the intellectual property regime grants to the owner. The result is an outright monopoly without restraint. The

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135. *Id.* "Technology transfer and respect for intellectual property go hand in hand. The decision of whether to transfer technology to country A or country B will, all other things being equal, go in favor of the country with strong protection for the foreign intellectual property." *Id.*

136. It has been suggested that research thus far has failed to come up with a conclusive cost/benefit analysis to justify the system or to push for its removal. *See* A. Samuel Oddi, *The International Patent System and Third World Development: Reality or Myth?* 5 DUKE L.J. 831 (1987).

137. The dominant emphasis on intellectual property is certainly misplaced. The greater burden for these countries is the education of the citizenry and the creation of an industrial infrastructure, without which the superstructure of available technologies is meaningless.

manipulation of market forces by the granting of monopoly protection to foreign owned intellectual property is not a desirable outcome for "recipient" or purchasing nations because it only serves to undermine domestic innovation.[138]

There is a clear contradiction between domestic transfer of technology policy and the international transfer of technology. Reason for this can be traced to U.S. science policy which brought about the conceptual dichotomy, and perpetuates it by the enactment of statutes designed to enhance the flow of technology into the United States while hindering and preventing its effective transfer outside the United States.

Some, perhaps, would argue that this dichotomy is inescapable. If this is true, then U.S. foreign aid packages, World Bank loans and other international institutional attempts to help facilitate structural reform in the Eastern block will fall short of its ultimate goal in that region, namely the success of democratic governance. Thus, while political restructuring through privatization in Asia, Africa Latin America and the Eastern block have created immense opportunities for American private industry, this reality suggests that the discourse on intellectual property and technology cannot be resolved as a simple matter of "law."

The government continues to lobby for strengthened intellectual property laws in foreign countries, as it simultaneously rejects intellectual property laws not "compatible with the perceived interest of the United States."[139] In other words the promise of technology transfer as a natural by-product of maintaining an intellectual property system is not true, or, alternatively, is only realizable if the laws are in consonance with certain interests.

The establishment of the office of the USTR, in combination with diplomatic and legal mechanisms to enforce intellectual property rights in the Third world may secure some significant returns. The success of these attempts may create short-term capital flows to the private sector, but will undermine the transfer of scientific information and ultimately the ability of underdeveloped countries to utilize technology to enhance their productivity. In addition there is no

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138. This is not a new argument, as it is traditionally made by scholars representing an underdeveloped country perspective. I restate this dominant position to outline the historical and economic implications of what is currently understood as technology transfer. This is in an effort to reveal its (lack of) impact on the scientific base and capacity of the recipient country.

139. A. Gutterman, *International Intellectual Property: Recent Developments and Issues for the Coming Decade*, 1 CURRENTS (Summer 1992).

data to suggest that these marginal returns will in any way yield the losses that infringement has purportedly cost the US economy.[140]

As the global community embraces the nascent democracies in Europe, and as other nations still experiment with capitalism and democracy, social order both national and international become highly interdependent with, and dependent on, the law for its structure. The rationale for granting monopoly rights to encourage innovation must surely be questioned if innovative ability is not encouraged in a country committed by international treaty to protecting those rights. Furthermore, if the construction of a more balanced system in the international scale is unachievable, the efficacy of an international regime which frustrates the objective of existing local intellectual property laws becomes questionable.

We have seen that the goals of technology transfer in domestic and international contexts are synonymous. It is to enhance scientific knowledge, to facilitate greater productivity and, thus, to generate new wealth. We have ascertained, too, that the modes of transfer employed in both contexts are, for the most part, the same. Yet one can be deemed feasible, while the other has historically been unsuccessful.

Under the auspices of the General Agreements on Tariff and Trade,[141] the West led by the U.S. has essentially moved on in reinforcing its institutional validation of the existing international intellectual property system. While agreements may exist on paper, the effective protection of intellectual property in the Third World remains doubtful. As long as the structural inequalities of the global market remain, the private sector which should be the arena for the resolution of such disputes will remain unable to rise up to the international problems of counterfeiting. Further, as long as the imbalance in power relations is reinforced by the use of political force to extrapolate agreements, it is not likely that comprehensive resolutions will emerge as suitable alternatives to the current system, undermining the original and fundamental objective of intellectual property protection, namely, the dissemination of information.

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140. *Id.* at 1-2.

141. The analysis in this paper is framed outside the context of any institutional arrangement such as the GATT even though intellectual property issues are a "high priority" for the U.S. in the Uruguay Round. I have done so because for countries not members of the GATT, or any other major multilateral trade agreement, the issue of technology transfer remains a vital and urgent political problem, carrying with it a plethora of socio-economic questions. As such, its discourse must of necessity be conducted in a context that allows the full participation of all countries, and the contribution of diverse disciplines.