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Intellectual Property Protection and Offshore Software Development: An Analysis of the U.S. Software Industry

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INTRODUCTION

In 1992, Bill Gates said, "take our twenty best people away and I tell you that Microsoft would become an unimportant company."[1] Software developers are critical to software companies and are generously rewarded for their services. The "fast track" to wealth attracts software developers from around the world to work for firms in the United States. Among *Fortune* magazine's richest Americans under the age of forty are three men of East Indian origin: Naveen Jain, 39, of Infospace, Sanjay Kumar, 32, of Computer Associates and Mukesh Chatter, 38, of Nexabit Networks.[2] The development of the *nouveaux riche* in information technology is one of the most visible effects of an organizational pattern of research and development that has had profound consequences for both overseas investments in these activities and the incentives to improve intellectual property protection of software products around the world. This Comment argues that this organizational pattern contributes to the concentration of software research and development in the U.S. and that improved overseas enforcement of copyright, trademark, and trade secret protection will not stimulate significant investment flows into these activities from U.S. software companies.

Most writers who have examined the role of intellectual property protection in developing countries have argued that

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1. RANDALL E. STROSS, THE MICROSOFT WAY 44 (1996).

2. *See*, *The IT Gold Rush: Made in India, Digitalised [sic] in US*, COMPUTERS TODAY, Dec. 31, 1999, at 72.

better protection generally has positive economic effects, whether measured in terms of increased foreign direct investment or rates of modernization and development. The works of Rapp and Rozek,[3] Robert Sherwood,[4] Edwin Mansfield,[5] and Belay Seyoum[6] subscribe to this broad view. Each of these studies suffer from one or more of the following limitations:

They fail to differentiate between the impact of intellectual property protection on different industry sectors. The research that does differentiate on an industry basis assumes that the high-tech industries are more receptive to rewarding improvements in enforcement of intellectual property rights with investments then the more traditional industries. This aspect is analyzed in greater detail in Section 2.4. The research holds that even in a high-tech industry such as the software industry, improvements in enforcement of copyright, trade secret, and trademark rights will not have a significant impact on overseas investments in research and development. However, this Comment's conclusions on the software industry are not necessarily applicable to other industries.

They mistake a correlation in the data for a causal connection between intellectual property protection and foreign direct investment. Countries that have a poor record of enforcement of software intellectual property rights, such as China and India, receive overseas investments. In the absence of particular analyses of these countries, the current literature presents an overly deterministic view of the relationship between investment and enforcement of intellectual property rights.

They ignore other factors that affect investment decisions, such as software firm and market structures, intellectual property protection strategies of U.S. companies, information costs, and the business practices of local suppliers. These aspects are not discussed in any of the above-mentioned

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3. *See generally* Richard T. Rapp & Richard P. Rozek, *Benefits and Costs of Intellectual Property Protection in Developing Countries*, NATIONAL ECONOMIC RESEARCH ASSOCIATES (1990).

4. *See* Robert M. Sherwood, *Intellectual Property Systems and Investment Stimulation: The Rating Systems in Eighteen Developing Countries*, 37 IDEA 261, 359 (1997).

5. *See generally* Edwin Mansfield, *Intellectual Property Protection, Direct Investment, and Technology Transfer*, 27 INT'L FIN. CORP. (1995).

6. *See* Belay Seyoum, *The Impact of Intellectual Property Rights on Foreign Direct Investment*, 31 COLUM. BUS. L. REV. 50, 51 (1996).

studies. In contrast, this Comment will provide evidence in support of the view that these factors are direct determinants of the concentration of software research and development in the U.S. This limitation of current research leads to an inaccurate depiction of the relationship between improved intellectual property protection and overseas investments in research and development—one in which investment rewards improvements in the overseas enforcement of intellectual property rights.

A recent U.N. study is more cautious about the benefits of improved intellectual property protection,[7] while other research concludes that the costs of intellectual property protection are higher than the benefits and that there is no positive economic outcome stemming from this type of protection.[8]

This article examines the relationship between overseas investment in software research and development and the enforcement of copyright, trademark, and trade secret protection in the host country. The data collected shows that there is at best a very weak relationship between levels of enforcement of these intellectual property rights (as measured by software piracy rates and U.S. Trade Representative designations) and levels of foreign direct investment in software development for any particular country. An overwhelming proportion of software research and development is carried out in the U.S.[9] The small share of these activities that is conducted overseas occurs in the industrialized countries, through alliances between companies from the U.S. and Europe.

Although there are alliances of U.S. software companies

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7. *See* TRANSNATIONAL CORPORATIONS AND MANAGEMENT DIVISION, UNITED NATIONS, INTELLECTUAL PROPERTY RIGHTS AND FOREIGN DIRECT INVESTMENT (1993) (stating that prior studies and recent surveys do not provide solid evidence on the relationship between intellectual property rights and foreign direct investment).

8. *See generally* A. Samuel Oddi, *The International Patent System and Third World Development: Reality or Myth?*, 1987 DUKE L. J. 831 (1987). "[M]any of those studying the international patent system as it relates to developing countries have concluded that it is economically unsound for such countries to have a patent system if an overwhelming majority of patents are granted to foreigners." *Id*. at 832.

9. *See* NATIONAL SCIENCE BOARD, SCIENCE AND ENGINEERING INDICATORS 1996 4-44 (1996) (stating that U.S. overseas research and development as a share of company-financed domestic research and development was about seven percent in 1993 for the non-manufacturing industries, including software development).

and suppliers from developing countries, for the most part these overseas suppliers perform software maintenance rather than design and development of new products.[10] Even in the most successful cases, overseas efforts to develop new software products account for less than twenty-five percent of local supplier business.[11] These trends are explained in greater detail in Section 3.

The data reveal that existing overseas investment bears little relation to levels of intellectual property enforcement. In fact, some of the leading recipients of software foreign direct investment have the worst levels of enforcement, despite changes in domestic formal rules that expand the scope of intellectual property protection. China, India, Korea, and Taiwan are clear examples of this trend. The recent experience of America Online (AOL) in Brazil provides an illustrative account of the situation that U.S. software companies face overseas. When some people tried to load AOL's new Brazilian Internet service last year, they were treated to the samba tune of dance band *Raca Negra*.[12] Thanks to a factory mix-up, a batch of AOL's start-up CD-ROMs contained the Brazilian group's hit song "Lost Time" instead of software connecting them to the Web.[13] But before AOL even got to the Web, a small-town Internet firm had nabbed the U.S. giant's logical address, aol.com.br.[14] Then free service providers mushroomed soon after AOL's Brazilian president quit only weeks after the

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10. *See* STEPHEN E. SIWEK & HAROLD W. FURCHTGOTT-ROTH, INTERNATIONAL TRADE IN COMPUTER SOFTWARE 139 (1993) (stating that the Indian software subsidiaries that have been established to date have focused on software maintenance rather than on software design or development. In November 1990, for example, Texas Instruments set up a new organization with facilities in Bangalore and in the U.S. known as IEF Software Reengineering Operations. The IEF (information engineering facility) operation is an attempt to address the vast need for software maintenance in the data processing centers of U.S. corporations. Various studies have found that the typical U.S. data processing environment spends anywhere from 60 to 80 percent of its efforts on the maintenance of existing systems. By combining low-cost Indian programmers with so-called CASE (computer aided software engineering) tools, Texas Instruments hopes to address this large and growing demand).

11. *See* N. Vittal, *India's New Lever of Growth*, COMPUTERS TODAY, July. 15, 1999, at 16.

12. *See* Pamela Druckerman & Nick Wingfield, *AOL's Big Assault on Latin America Hits Snags in Brazil*, WALL ST. J., July 11, 2000, at A1.

13. *See id.*

14. *See id.*

company went online; he ended up with a competitor.[15]

Public enforcement in developing countries can be improved if international and domestic intellectual property policies are aligned with the needs of local software suppliers. These actors share U.S. concerns over software piracy and have taken a stance to defend their rights.[16]

Section I reviews the current literature on the economic impact of intellectual property protection. While summarizing complex articles in a few pages does not do justice to the richness of the literature, this review is indispensable to assess the broader implications of this Comment.

Section II develops a theory of the concentration of research and development activities in the U.S. on the basis of the collective learning needs of these companies, the dictates of the U.S. market and the intellectual property protection strategies of U.S. software companies. Current literature on research and development organizational arrangements was used to explain the trends reflected in the National Science Board indicators. This section also provides a brief history of intellectual property protection in the software industry and discusses attitudes towards the enforcement of intellectual property rights and software piracy.

Software piracy estimates collected by the Business Software Alliance and U.S. Trade Representative country reports were used to estimate the enforcement of intellectual property rights in developing countries with a significant presence of software suppliers. In the absence of systematic data on overseas U.S. investment in software research and development, this Comment relied on reports of country exports of software products to the U.S. to determine the presence of a significant software industry performing outsourcing functions for U.S. companies. The science and engineering indicators published by the National Science Board were used to highlight (a) the level of concentration of software research and development in the U.S.; (b) the number of strategic research and development alliances; and (c) the nationality of the participants in the alliances. The presentation of these overall

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15. *See id.*

16. *See* INTER-AMERICAN DEVELOPMENT BANK 23 (1999) (stating that a major Korean word processing software publisher, Hangul and Computer, was threatened with bankruptcy until a concerted nationwide effort was undertaken to end piracy of its products and to legalize pirated versions already installed).

trends was supplemented with examples from prominent corporations, such as Apple, IBM, and Microsoft. Data on patent counts by class by year collected by the U.S. Patents and Trademarks Office was used to illustrate the greater reliance on intellectual property protection currently prevalent in the information industry.

Two key arguments are presented in Section III. First, organizational and market considerations act as inhibiting factors of overseas investment in software research and development. At the firm level, companies concentrate their human capital involved in research and development to maximize collective learning and stimulate innovation. At the market level, the overwhelming size of the U.S. market encourages software companies to locate their research and development activities in this country. This facilitates effective and timely response to changes in market conditions.

Second, enforcement of copyright, trade secret, and trademark protection is viewed by U.S. software companies as a means of protecting and recouping research and development costs, but considered only as one of a number of factors influencing overseas investment decisions. This goes some way towards explaining why some countries with weak enforcement are leading recipients of foreign direct investment by U.S. software companies. In the case of China and India, market potential presumably offsets the risk of loss from poor intellectual property enforcement. An example is software giant Microsoft, which has research facilities in China and India to develop software products.

Section III examines the implications of the weak relationship between enforcement of intellectual property rights and overseas research and development investments for current international efforts to strengthen software protection. Country reports from the U.S. Trade Representative and the literature that evaluates U.S. efforts in countries that have significant enforcement problems were used to provide an overall assessment of U.S. policies.

What are the consequences of the poor relationship between intellectual property enforcement and overseas investments in software research and development? This Comment addresses this question in the context of ongoing international efforts to improve enforcement of intellectual

property rights promoted by U.S. authorities[17] and the software industry.[18] A fundamental contradiction lies at the core of international intellectual property policies: developing countries participate in these efforts to attract overseas investments, while the potential investors, the U.S. software companies, are more interested in protecting their investments in their home country. U.S.T.R. policy supports company interests.[19]

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17. *See* United States Trade Representative, *"Special 301" on Intellectual Property Rights Fact Sheet* (visited Jan.15, 2000) <http://www.ustr.gov/reports/301report/factsheets.htm.> (stating that amended Section 301 of The Trade Act of 1974 requires the U.S.T.R. to investigate countries that have a history of violating laws and agreements dealing with intellectual property rights). Countries whose observance of intellectual property rights are sub-par are placed on: (a) a priority watch list, which opens bilateral discussions, or (b) a watch list which means that U.S. authorities will monitor progress in implementing commitments with regard to the protection of intellectual property rights and providing comparable market access for U.S. intellectual property products. *See id.* The worst offenders, called priority foreign countries, can be subject to trade sanctions. *See id.* The current priority watch countries with deficient software protection are Greece, India, Indonesia, and Korea. *See id.* The watch list is composed of 26 countries of which the following have been singled out for software piracy: Brazil, Chile, Kuwait, Paraguay, the Philippines, the Russian Federation, Saudi Arabia, Singapore, United Arab Emirates, and Thailand. *See id.* China is the single priority foreign country. *See id.*

18. In accordance with U.S. intellectual property policy, software companies sponsor joint efforts to stop piracy, most notably under the auspices of the Business Software Alliance (BSA). Established in 1988, the BSA seeks to (a) educate computer users on software rights; (b) advocate public policy that fosters innovation and expands trade opportunities; and (c) fight software piracy. *See* Business Software Alliance, About BSA (visited Dec. 3, 2000) <http://www.bsa.org/USA/about/>. BSA worldwide members include industry giants Adobe Systems Incorporated, Attachmate Corporation, Lotus Development Corporation, Macromedia, Microsoft Corporation, Network Associates, Novell, Symantec Corporation, and Visio Corporation. Additional members of BSA's Policy Council include Apple Computer, Compaq Computer Corporation, IBM, Intel Corporation, Intuit, and Sybase. *See* Business Software Alliance, About BSA (visited Dec. 3, 2000) <http://www.bsa.org/USA/about/members_list_c.phtml>. The member companies account for over 70% of the U.S. prepackaged software market. The BSA sometimes conducts surprise raids on companies suspected of using pirated versions of computer software. *See* Business Software Alliance, Atlanta Law Firm Settles Software Piracy Claims (visited Oct. 31, 2000) <http://www.bsa.org/USA/press/newsreleases//2000-10-31,356.phtml> (stating that in some cases the BSA will pursue software raids).

19. *See* BENEDICTE CALLAN, PIRATES ON THE HIGH SEAS 2-3 (1998). The first objective of current U.S. policy is strengthening U.S. exports in the entertainment and technology industries. *See id.* The second objective is to combat the free rider problem inherent in industrial research and development investments. *See id.* A third objective is to expand the

The cornerstone of current international policies is improving public enforcement of intellectual property rights in developing countries.[20] The weak relationship between the enforcement of intellectual property rights and overseas investments jeopardizes developing country commitment to improved public enforcement. The modest flow of investments suggests that enforcement might not be significantly improved and U.S. losses will not be substantially reduced, even if traditional obstacles to the enforcement of intellectual property rights are overcome. The obstacles include: (1) differences in attitude[21] and culture,[22] particularly between Asian and European societies; (2) nationalist bias against U.S. companies in courts[23] and legislatures;[24] (3) administrative deficiencies;[25]

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innovation pie for all countries under the assumption that access to technology would spur growth in developing countries. *See id.*

20. For the purposes of this paper, public enforcement is the commitment of national governments to: (1) allocate resources to police agencies that investigate piracy; (2) eradicate police corruption in the enforcement process; and (3) promote awareness in local courts on the importance of protecting foreign intellectual property.

21. *See* Richard J. Ansson, Jr., *International Intellectual Property Rights, the United States and the People's Republic of China*, 13 TEMP. INT'L & COMP. L.J. 1, 24 (1999) (stating that copyright in the West is a payoff to encourage individual authors to create, whereas in the East it is not uncommon for an artist to gain validity by mimicking previous works).

22. *See* William J. Bien, Structural Impediments to Chinese Enforcement of Intellectual Property Rights 5-6 (Aug. 1996) (unpublished manuscript, on file with the author). This manuscript states that fears that the computer industry can contribute to cultural "contamination" are not a rarity among the Chinese leadership. *See id.* at 6. These fears are coupled with a puritan sense of morality. *See id.*

23. *See* Theodore G. Bryant, *The History, Development and Changing Environment of Protecting Computer Software Against Copyright Violation in Brazil*, 8 TRANSNAT'L LAW. 375, 377 n. 10 (1995) (highlighting that Microsoft won a $10 million award in a software piracy case in 1993. The defendant was Prologica Microcomputers, a major Brazilian computer manufacturer accused of selling unauthorized versions of Microsoft's Disk Operating System (DOS). Prologica installed the software directly onto the computers they manufactured, and claimed the application, which they labeled SO-16 was independently created. An audit of Prologica's records ordered by the court, revealed that the company had spent no money on research and development. However, Microsoft's victory was only the second such judicial decision in favor of a foreign manufacturer of software against a local Brazilian violator).

24. *See* Weiqiu Long, *Intellectual Property in China,* 31 ST. MARY'S L.J. 63, 86 (1999) (stating that the 1999 copyright law of China establishes that national interest limits the scope of software copyright). Article 31 of the 1990 Copyright Law provides that the similarity between newly developed and existing software will not constitute copyright infringement if the similarity is necessary for the execution of national policies, laws, regulations, or rules, or for the implementation of national technical standards. *See id.* at 87. In such

and (4) corruption.[26]

Section IV presents guidelines to develop international and domestic policies that can strengthen local software suppliers so that they can become effective promoters of improved intellectual property rights enforcement. The arguments in favor of a policy alignment along these lines are outlined below. First, government officials in developing countries need to understand why improving enforcement of software intellectual property rights is in the national interest. Software is protected by copyright, trademark, and trade secret domestic laws in the countries that are discussed in this study. However, government officials may have an inducement to lax enforcement, at least for educational or small business use. Promoting the development of a local software industry is a plausible goal that can motivate these authorities to engage in sustained efforts to improve intellectual property protection. Governments from developing countries might be more receptive to international efforts to improve intellectual property protection if these efforts are congruent with domestic policies to strengthen local software industries and establish competitive supplier markets.[27] Furthermore, the prestige and performance record of local suppliers may influence investment decisions. A company representative interviewed for this project stated that "we will be more likely to invest in a country if we can find out who are the local suppliers we can trust." This is particularly plausible in cases of overseas investments to develop products for the U.S. market, where delays or deficiencies of overseas subcontractors can affect the responsiveness of U.S. companies to changes in the U.S. market.

Second, local suppliers can play a role in overcoming nationalist and administrative barriers to improvements in public enforcement of intellectual property rights. With adequate organizational and financial resources, they can put

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instances, no compensation is provided to the copyright holder. *See id.*

25. *See* Bryant, *supra* note 23, at 381 (discussing the Brazilian attitude that intellectual property violations are a cost of doing business).

26. *See* Bien, *supra* note 22, at 7 (stating that in China, public security agencies seem to value their investment in counterfeiting factories more than they value the law).

27. *But see* LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE 225 (1999) (arguing that intellectual property protection can limit competition by creating incentives to hide code rather than to make its functionality obvious).

pressure on local authorities to commit to public enforcement of intellectual property rights. Improvements in enforcement encouraged by local software suppliers will benefit U.S. research and development activities.

Policy changes can strengthen the position of local software suppliers. At the international level, the U.S. software industry should support the efforts of software suppliers to improve their organization for collective action as well as provide them financial assistance to defend their intellectual property rights in courts.[28] At the domestic level, in addition to improvements in intellectual property protection,[29] development policies should address the requirements of the software industry, particularly human capital and financial support.

I. THE CONVENTIONAL CONCEPTUALIZATION OF THE ECONOMIC IMPACT OF INTELLECTUAL PROPERTY PROTECTION

A. OVERVIEW

Four analytical categories were selected to compare the research. The first category focuses on the type of relationship established in each work. This relationship is formed by intellectual property rights or a sub-set of these rights, such as patent rights, the protection of which may or may not have a particular economic impact, such as modernization, development, foreign direct investment or technology transfer. The second category focuses on the question of whether intervening economic policies and political factors are perceived

28. *See generally* NEIL K. KOMESAR, IMPERFECT ALTERNATIVES. CHOOSING INSTITUTIONS IN LAW, ECONOMICS AND PUBLIC POLICY 127 (1994) (stating that the formalities and complexities of participation in the adjudicative process require a significant accumulation of knowledge and experience. By contrast, consumers and voters often face a far less expensive road to registering their needs in the market or the political process).

29. *See* Lionel L. Lavenue, *Database Rights and Technical Data Rights: The Expansion of Intellectual Property for the Protection of Databases*, SANTA CLARA L. REV. 1, 21 (1997) (stating that although most states consider the misappropriation of trade secrets a civil matter, more and more states are beginning also to recognize criminal sanctions for the improper appropriation of trade secrets. These sanctions are particularly relevant to computer companies because trade secrecy provides a particularly advantageous means of protection because software may be licensed and distributed without disclosure of the actual code).

by the researchers to play a role in limiting the economic impact of intellectual property rights. The third category compares the existing research on the basis of whether the economic impact of intellectual property rights is assessed in particular industries or in the economy as a whole. Finally, the fourth category presents some of the key conclusions of the reviewed literature that are of major relevance to this study. Sections 2.2 through 2.5 discuss each of these categories in greater detail.

The following table is the reference point to analyze the recent research on the economic impact of intellectual property protection:

Table 1

Key Features of the Conventional Conceptualizations on the Economic Impact of Intellectual Property Protection

	Type of relationship	**Mediating factors**	**Analyzed industries**	**Conclusions**
Rapp and Rozek	Intellectual property rights/ Moderni-zation	None	Pharmaceut-ical industry	Causal linkage between intellectual property protection and moderni-zation.
Robert Sherwood	Intellectual property rights/ Foreign direct investment	None	Undifferenti-ated	Correlation between intellectual property protection and foreign direct investment.

Edwin Mansfield	Intellectual property rights/ foreign direct investment and technology transfer	Size of market, degree of industrial-ization, openness of economy	Chemicals, pharmaceut-icals, machinery and electrical equipment	Causal relationship between intellectual property protection and foreign direct investment.
Belay Seyoum	Intellectual property rights/ Foreign direct investment	Market size (change in GDP), public investment as a ratio of GDP, external debt to exports and exchange rates	Undifferenti-ated	Correlation between intellectual property protection and foreign direct investment.
United Nations Trans-national Corpora-tions and Manage-ment Division	Intellectual property rights/foreign direct investment	Rapid economic growth, low costs, relative stability, growing labor skill and technological capabilities	Pharmaceut-icals, software, chemicals, electrical engineering	Inconclusive evidence of a relation between intellectual property protection and foreign direct investment.
Samuel Oddi	Participation in international patent system/ development	Political stability, materials and labor force available at competitive costs, international and local market	Undifferenti-ated	No relation between patent protection and development.

B. TYPE OF RELATIONSHIP

Rapp and Rozek investigated the benefits and costs of strong intellectual property protection in the pharmaceutical industry. Their research sought to establish a relationship between intellectual property protection and modernization. Modernization was operationalized in eight variables: (1) per capita gross domestic product; (2) percentage of households with electricity; (3) percentage of households with water; (4) presence of a social security system; (5) infant mortality; (6) percentage of the workforce in agriculture; (7) proportion of physicians to total population; and (8) whether the country is a former British colony.[30]

The impact of patent protection on the above stated variables is in all likelihood diffuse. Establishing a correlation between intellectual property protection and some of the variables (presence of a social security system, proportion of total physicians to total population) might not be a fruitful exercise because any correlation is highly unlikely. Rapp and Rozek could have chosen variables of modernization that reflect the growing level of industrialization of a country, such the share of GDP that corresponds to high-tech goods, or the proportion of the workforce in the technology sector. If they had chosen this path, they would have been in a better position to establish a correlation between modernization and intellectual property protection.

Samuel Oddi sought to address the validity of the assumption that there is a causal relationship between a developing country's participation in the international patent system and its economic development. He analyzed whether the traditional cost benefit analysis for patent systems in developed countries applies to developing countries, and then focused on the legal and economic consequences of participation by developing countries in the legal regime of the international patent system as primarily embodied in the Paris Convention for the Protection of Industrial Property of 1883.[31] Development is too broad a category to use in determining the impact of the patent system.

Furthermore, it appears that "development" has different meanings throughout Oddi's work. It can refer to the

30. *See* Rapp & Rozek, *supra* note 3, at 8.
31. *See* Oddi, *supra* note 8, at 836.

availability of inventions in a country,[32] to technology transfer,[33] or to foreign direct investment.[34] Arguably, not all of these criteria are evidence of development. That a country can allow the importation of software is not necessarily an indication of development. It merely reflects the absence of trade restrictions. Additionally, not all foreign direct investment provides a significant boost to development. If a U.S. software company sells its products in developing countries, it may be contributing to local employment much more than to the development of the country. Only technology transfer is directly related to development.

Robert Sherwood and Belay Seyoum analyzed the relationship between the protection of intellectual property rights and foreign direct investment. This approach is bound to lead to more fruitful conclusions than Rapp and Rozek's work because it is easier to assess the impact of intellectual property protection on a narrower economic dimension, such as foreign direct investment, than on the broader notion of modernization. The same argument applies to Oddi's use of development as a reference point, because development is too broad to lend itself to conclusions that can be directly traced to the patent system. However, the Sherwood and Seyoum research can be refined by distinguishing the different types of investment that can be stimulated through the protection of intellectual property rights.

Edwin Mansfield takes up the task of assessing the impact of intellectual property rights on different types of investment. His research sought to establish a relationship between intellectual property rights, foreign direct investment and technology transfer. The U.N. study directly refers to Mansfield's research, acknowledging the empirical relevance of assessing intellectual property protection in the context of different types of investment.[35]

This article avoids establishing a relationship between intellectual property protection and the broad notions of modernization and development. Influenced by Mansfield, the research that was conducted to develop this Comment discriminated between different types of investment. However, this Comment challenges a key assumption of the Mansfield

32. *See id.* at 848.
33. *See id.* at 852.
34. *See id.* at 849.
35. *See* UNITED NATIONS, *supra* note 7, at 5.

analysis. Mansfield's assumption is that investments in research and development are more sensitive to improvements in intellectual property protection than other types of investments such as distribution and sales. The Microsoft experience in China illustrates this point. Nancy Anderson, Associate Counsel at Microsoft, communicated to the author that the company did not have a choice in deciding whether to market their products in China. "Our products were already in China, and they were being supplied by software pirates." It was therefore in the company's interest to invest in distribution and sales. This is within the Mansfield argument. However, Microsoft decided to establish a software development facility in China, despite the fact that nine out of ten software copies sold in China are pirated. The mediating factors that explain Microsoft's decision are discussed in the next section.

C. MEDIATING FACTORS

Concerning the question of mediating factors in the relationship between protection of intellectual property rights and a desired economic outcome (modernization, development, foreign direct investment, or technology transfer, in accordance with each particular body of research), the works of Rapp and Rozek and Sherwood do not take into account that intervening policies not related to the question of enforcement of these rights can have an impact on technology transfer. Oddi argues that many factors beyond the availability of a patent system enter into a decision about whether to invest in a particular developing country.[36] However, there are no clear guidelines in the Oddi research as to how to weigh these factors.

Mansfield and Seyoum assessed the particular influence of the mediating factors in the relationship between intellectual property rights and economic outcomes. Mansfield took into account the impact of the size of market, the degree of industrialization, and the openness of the economy, and how they relate to intellectual property rights, foreign direct investment, and technology transfer.[37]

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36. *See* Oddi, *supra* note 8, at 849 (arguing that among these factors are: (1) the political stability of a country; (2) the availability of materials and labor force at competitive costs; and (3) the international as well as the local market).

37. This analysis of the software industry suggests that the potential market of the host country can override concerns for intellectual property

Seyoum sought to determine the relationship between foreign direct investment and intellectual property rights protection taking into account the role played by the following economic variables: (1) levels of economic growth as measured by changes in GDP; (2) the rate of public sector investment; (3) the size of external debt relative to GDP; and (4) macroeconomic stability as measured by the exchange rate. He assumed that higher levels of intellectual property protection increase foreign direct activity, as do higher levels of economic growth, public sector investment, external borrowing, and low exchange rates.

Why is it important to analyze the economic policies of the host country when assessing the impact of intellectual property protection on investment and technology transfer? A recent study by Charles-Albert Michalet contends that the investment strategies of multinational corporations take into account the following features of host countries: (1) presence of a stable and facilitating political and economic base and a transparent and non-discretionary legal and regulatory framework; (2) an attractive market characterized by a strong and sustained rate of growth, an equitable distribution of domestic income, expansion and integration of the regional market; and (3) the existence of adequate human capital and technical capabilities. Even though Michalet does not expressly address intellectual property rights, they are a contributing factor to the stable political and legal framework. Yet this broad legal and political base on its own cannot ensure foreign direct investment; it is merely a contributing factor in the investment decisions of multinational corporations.[38]

The U.N. study is even more cautious than Michalet concerning the impact of these types of legal factors in promoting foreign direct investment. The study holds that (1)

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protection. The experience of Microsoft in China illustrates this argument. The company is willing to invest in research and development in this country despite deficient intellectual property protection because the market size is attractive.

38. *See* Charles-Albert Michalet, *Investment Strategies of Multinational Corporations and the Attractiveness of Host Countries*, 10 THE WORLD BANK 2-3 (1997) (arguing that firms' perceptions and choices among the developing and transition countries are focused on a number of restricted "core countries." These countries have comparable political, legal and economic features. Without them, a country is excluded from the core. This gets a country in the investor's "short list" of priority locations. Therefore, an investment promotion policy's chances of success will depend on its ability to move a country out of the circle of "potential" candidates and into the circle of "core countries").

rapid economic growth; (2) low costs; (3) relative stability; (4) growing labor skills; and (5) technological capabilities have opened significant opportunities in countries that have inadequate intellectual property protection offsetting these deficiencies. On the other hand, where the economic environment is unfavorable or lacking in industrial or technological infrastructure, adopting high intellectual property standards will not have a significant effect on intellectual property protection.[39]

None of the studies analyzed two mediating factors that play a pivotal role in overseas research and development investments: (1) organizational arrangements and strategies of companies, and (2) information costs incurred by U.S. companies seeking overseas suppliers. This Comment provides evidence in support of the view that the organizational integration of the software companies hinders offshore investments in software development. In addition, the task of distinguishing the skills offered by the many different offshore suppliers[40] is not cost-effective for U.S. companies. This cost is a greater obstacle to software development alliances than the shortcomings of intellectual property protection in the developing countries. In an interview conducted in support of this Comment, a representative of a U.S. high-tech corporation stated that umbrella associations with the records of local suppliers are a valuable asset for countries seeking to attract contracts from U.S. software companies to develop products.

D. OVERALL ECONOMIC ANALYSIS VERSUS U.S. INDUSTRY — SPECIFIC STUDIES

A key distinction among the studies is whether particular industries are taken into account to assess the relationship between intellectual property protection and economic processes, or whether the assessment of the relationship is based on an overview of the economy of each country. Sherwood and Seyoum are supporters of the broad and undifferentiated positive impact of intellectual property

39. *See* UNITED NATIONS, *supra* note 7, at 4.

40. *See* INTERNATIONAL DATA CORPORATION, THE GRAY SHEET COMPUTER INDUSTRY REPORT 7 (1993) (stating that the decision to invest in offshore software development is based on the following features of the subcontractor: positive and negative corporate characteristics, methodologies, management philosophies, ethical standards, facilities and financial stability).

protection. Oddi provides the counterargument that patent protection does not correlate with development. Both lines of argument draw broad conclusions, although at opposite ends of the spectrum.

The U.N. study cautions against this broad approach shared by Seyoum, Sherwood and Oddi because in all likelihood this type of analysis does not capture the consequences of changes in property rights.[41] The U.N. study argues that intellectual property rights do not have the same importance and effects in every industry, given, among other factors, (1) the varying intensity in research and development; (2) the speed of technological change; (3) the relative significance of formalized and tacit knowledge; and (4) the type of producer/user relationship. The U.N. study briefly discusses the varying importance of intellectual property rights in the pharmaceutical, software, chemicals, and electrical engineering industries.[42] However, the study draws few conclusions.

Mansfield concluded that in relatively high-technology industries such as chemical, pharmaceutical, machinery, and electrical equipment, the system of intellectual property protection of a country often has a significant effect on the amount and type of technology transfer and direct investment in that country by German, Japanese, and U.S. firms. The percentage of firms that consider patent protection a high priority was higher in these sectors than in the transportation equipment, metals, or food industries.[43] The evidence presented in this Comment suggests that Mansfield's conclusion should be taken with caution. Overseas investments in software development do not seem to be highly sensitive to the differences in enforcement of intellectual property rights offered by host countries. The representatives of high-tech companies interviewed for this Comment stated that local human capital and economic incentives affected investment decisions more than the different levels of enforcement of intellectual property rights in these countries. Therefore, there is no clear relationship between the level of technology intensity in an industry, offshore research and development investment, and improvements in enforcement of intellectual property rights.

Rapp and Rozek relied on an industry-specific analysis.

41. *See id.* at 25.
42. *See id.* at 6-7.
43. *See* Mansfield, *supra* note 5, at 2.

However, their study focused narrowly on patent protection in the pharmaceutical industry. This tends to limit the impact of their work, as it would be improper to draw broad conclusions about the influence of the intellectual property protection on modernization based exclusively on a single case study.

E. CONCLUSIONS OF THE EXISTING RESEARCH

Rapp and Rozek concluded that nations with stronger patent systems enjoyed more rapid economic development for three reasons: (1) sophisticated patent rights foster economic growth by increasing the rate of innovation and investment in innovative activities; (2) underdeveloped property rights impede economic advancement, causing inadequate patent systems to be associated with economic backwardness; and (3) the process of economic development causes patents and other intellectual property rights to appreciate in value due to enhanced sales and profits from their use.[44]

The Rapp and Rozek study clearly shows that for the majority of countries analyzed, there was a correlation between patent protection and modernization. Furthermore, they support their views with data that indicates that pharmaceutical research and development is conducted in most countries where intellectual property is protected.[45] Based on their research findings, Rapp and Rozek concluded that there was a causal relationship between the presence of efficient intellectual property rights and economic modernization.[46] The modernization and patent protection data revealed that the relationship between them was valid, with the exception of "about" twenty countries, which, according to Rapp and Rozek, have good prospects for economic growth, but have failed to revise outdated patent laws and run the risk of discouraging technological change.[47]

The fact that patent protection and modernization

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44. *See* Rapp & Rozek, *supra* note 3, at 14-22.

45. *See id.* at i (stating that about 70% of U.S. pharmaceutical research and development abroad is in Western Europe, and the share in other countries with strong protection, such as Japan and Australia, is growing. By contrast, in Latin America and Africa, where most countries have been reluctant to improve intellectual property protection, the proportion of research and development spending by U.S. firms has decreased significantly to less than three percent of the total).

46. *See id.*

47. *See id.*

correlate does not mean that there is a causal relationship. It might well be the case that as countries "modernize," economic groups with an interest in strengthening the patent system gain political influence. Thus, the actual relationship might be the reverse of the one suggested by Rapp and Rozek.

Sherwood holds that there is a correlation between intellectual property protection and foreign direct investment. He supports his conclusion with a comparison of his findings with the research conducted by Mansfield, Seyoum, and Rapp and Rozek. However, Sherwood could have sought to prove or disclaim the relationship in his interview process. He could have asked the participants what factors lead to changes in intellectual property protection. Do changes in the formal rules empower groups that have an interest in enforcement of intellectual property rights, or rather, do the groups pushing for changes in the formal rules encourage higher levels of enforcement? In all likelihood, the process is a "two way street" in which organizations interact with institutions, influencing each other.[48]

According to Mansfield, the variations in the amount of U.S. foreign direct investment can be explained by the size of the market, the stock of prior foreign direct investment in the country, and a measure of the weakness of intellectual property protection in the country.[49] However, with the exception of intellectual property protection, it is not clear how the other factors are assessed in his research. Given that Mansfield confined his interviews to people knowledgeable on patent issues, it would seem likely that the other factors affecting foreign direct investment and technology transfer would not be fully accounted for by his interviewees. This highlights a problem faced by current research on the impact of intellectual property protection: how to isolate the effects of intellectual property protection and distinguish them from the influence of other factors.[50]

Seyoum concluded that intellectual property rights have a positive impact on investment, as do market size and public

48. *See* DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 7 (1990) (arguing that institutions determine the opportunities in a society and organizations are created to take advantage of those opportunities and as the organizations evolve they alter the institutions).

49. *See* Mansfield, *supra* note 5, at 23.

50. *See* UNITED NATIONS, *supra* note 7, at 1.

investment rates.[51] Foreign direct investment in the developed countries tends to be in research-intensive sectors that are less influenced by the availability of resources or market size. This means that such firms are less likely to transfer advanced technology to countries with weak protection for certain intellectual property rights, such as copyrights or trademarks.[52]

The U.N. study concluded that there is an "uncertain relationship" between intellectual property protection and the volume and composition of foreign direct investment. Much innovative activity in developing countries is imitative, associated with smaller innovations with a significant informal component. The importance of trade secrets and petty patents in stimulating incremental innovative activity suggests that there is considerable scope for measures, other than legislative changes on intellectual property rights, to enhance performance in this area.[53]

Oddi argues that there is no evidence to support the claim that a patent incentive should be provided to induce the creation of needed innovations. He states that the overwhelming majority of patents granted by developing countries are assigned to foreigners, while a significant number of patents granted in any given developed country are granted to its nationals.[54] By protecting inventions, particularly foreign inventions that are not patent induced, developing countries significantly add to the cost side of the cost/benefit analysis applied in Oddi's work. Regarding foreign direct investment, Oddi claims that the absence of patent protection may sometimes be a factor leading to foreign investment. For example, foreign investment in the manufacture of generic drugs could be induced in those developing countries that do not protect pharmaceuticals.[55]

The clear weight of the evidence suggests that improved enforcement of intellectual property rights does not significantly contribute to offshore investment in software development. If software producers relied on the quality of enforcement of intellectual property rights to determine offshore investment, there would be a strong positive relation between investments and improvements in enforcement. For

51. *See* Seyoum, *supra* note 6, at 55.
52. *See id.* at 58.
53. *See* UNITED NATIONS, *supra* note 7, at 25.
54. *See* Oddi, *supra* note 8, at 853.
55. *See id.* at 849.

the purpose of this argument, a list of countries reported to have U.S. offshore investments in software development was compiled. These countries are the major exporters of software products to the U.S. The quality of intellectual property rights enforcement was assessed on the basis of their software piracy rates[56] and the U.S. Trade Representative country reports on the state of intellectual property protection. While the U.S.T.R. country reports are not exempt from the critique that political motivations come to play in their conclusions, they can provide a basic reference point to determine the level of enforcement of U.S. intellectual property rights. The BSA studies serve the same purpose, provided that their cost/benefit analyses are used to convey a broad perspective on the illegal use of software. The following table presents the results of this exercise:

Table 2

Selected Data on the Enforcement of Intellectual Property Rights in Several Countries

Country	**Software Exports to U.S. (millions of U.S. dollars)**			**Rate of Software Piracy**				**U.S.T.R. Status**
	1990	1992	1994	1994	1995	1996	1997	
Canada	55.9	108.5	117.1	46%	44%	42%	39%	Watch list
Singapore	9.7	17.9	69.8	61%	53%	59%	56%	Watch list
U.K.	12.7	26.4	30.9	42%	38%	34%	31%	-
Japan	22.2	28.7	26.0	66%	55%	41%	32%	Priority watch list
France	7.4	6.7	13.5	53%	51%	45%	44%	-
Taiwan	5.9	13.6	13.2	72%	70%	66%	63%	-
Argentina	0.2	0.1	7.5	80%	80%	71%	65%	Priority watch list

56. *See* Business Software Alliance, *1999 Global Software Piracy Report* (visited Nov. 29, 2000) <http://www.bsa.org/USA/globallib/piracy/piracy stats99.phtml>.

China	0.2	4.8	6.2	97%	96%	96%	96%	Priority foreign country
India	0.7	0.7	4.8[57]	79%	78%	79%	69%	Priority watch list
Italy	1.0	1.2	2.9	69%	61%	55%	43%	Watch list
Hong Kong	1.5	9.1	2.5	62%	62%	64%	67%	-
Korea	2.2	2.0	1.1	75%	76%	70%	67%	Priority watch list

This table reveals that countries with the largest volumes of software exports to the U.S. have different rates of software piracy and different standing with the U.S.T.R. Canada and Singapore are the top software exporters; however, Singapore's piracy rate is significantly higher than the corresponding Canadian rate. Among the five major software exporters, one is in good standing with the U.S.T.R., two are on the watch list, and one is on the priority watch list. This supports the view that there is no direct relationship between software research and development investments and the enforcement of intellectual property rights. Maskus reaches the same conclusion in a broader study of the relationship between foreign direct investment flows and intellectual property protection.[58]

II. THE CONCENTRATION OF SOFTWARE RESEARCH AND DEVELOPMENT

A. THE BROAD PATTERNS

This section will provide evidence in support of this Comment's view that the concentration of research and development activities is widespread among U.S. software companies. Before doing so, the current alternatives to software research and development concentration will be highlighted. This provides the necessary background so that

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[57] *See* Vittal, *supra* note 11, at 16 (placing the total value of Indian software exports at $2.6 billion in 1998).

58. *See* Keith E. Maskus, *The Role of Intellectual Property Rights in Encouraging Foreign Direct Investment and Technology* Transfer, 9 DUKE J. COMP. & INT'L L. 109, 128-29 (1998) (arguing that strong intellectual property rights alone do not sufficiently generate strong incentives for firms to invest in a country. If that were the case, then recent foreign direct investment flows would have largely gone to Eastern Europe and other emerging regions with stronger intellectual property rights. In contrast, Brazil, China, and other high-growth, large-market developing economies with weak intellectual property rights would have attracted less direct foreign investment).

we can build on the research that preceded this Comment.

A review of the literature reveals that the U.S. software industry follows three types of research and development strategies: (1) concentration of these activities in the U.S.; (2) strategic alliances with companies from other industrialized countries; and (3) investments in offshore software development. Leading U.S. companies place their research and development facilities in their home country.[59] Other research suggests that this trend is not limited to the software industry.[60] The second strategy is becoming more common in the industry. Information technology alliances doubled between 1980 and 1994, reaching almost five hundred. The largest number of these relationships has been between U.S. and European firms, although the number of intra-European alliances is also substantial.[61]

The software producers that follow the third strategy have sought to exploit the lower costs of foreign programmers by moving software development activities overseas.[62] However,

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59. *See* STROSS, *supra* note 1, at 130-31 (stating that in 1991, Microsoft decided to end the practice of researchers being dispersed in the company, choosing to group them together. Other examples of this trend are: (a) the Palo Alto Research Center of Xerox; (b) IBM's Watson Research Center; and (c) Apple's Advanced Technology Group).

60. *See* Parimal Patel & Keith Pavitt, *Uneven (and divergent) Technological Accumulation Among Advanced Countries: Evidence and a Framework of Explanation*, TECHNOLOGY, ORGANIZATION AND COMPETITIVENESS. PERSPECTIVES ON INDUSTRIAL AND CORPORATE CHANGE 303-04 (1998) (arguing that firms making products with the highest technology intensities, such as aircraft, instruments, motor vehicles, computers and other electrical products are among those with the lowest degrees of internationalization of their underlying technological activities. In all of these products, links between research and development and design, on the one hand, and production on the other, are particularly important in the launching of major new products and benefit from geographical proximity).

61. *See* NATIONAL SCIENCE BOARD, *supra* note 9, at 4-44.

62. *See* SIWEK & FURCHTGOTT-ROTH, *supra* note 10, at 65-67 (stating that Ashton-Tate, Claris, Lotus, Microsoft and other developers are in different stages of transferring some of their research and development activities to Ireland. Attracted in part by lower programmer wages, U.S. companies have also formed joint ventures in several Asian nations to develop software. IBM, for example, formed a joint venture with Taiwan's government-supported Institute for Information Industry to form a company, called International Integrated Systems Inc., to develop software for IBM. In 1986, Texas Instruments established a wholly owned subsidiary in Bangalore to develop and maintain its proprietary CAD software. Hewlett-Packard also runs an offshore subsidiary, the India Software Organization (ISO) in Bombay. In addition, Ashton-Tate plans to relocate university-trained programmers to the U.S. from India, where the average annual cost of programmers (salary and

captive development organizations in foreign countries require an up-front investment in sophisticated data telecommunications links, most likely by satellite.[63] This incremental capital requirement reduces the foreign country's labor cost advantage over U.S.-based programmers. Nevertheless, as international telecommunications costs fall, captive development functions of this type should become increasingly cost effective in the future.

Research and development undertaken abroad is not meant to displace domestic efforts. Rather, offshore research and development tends to follow overseas production activities and is intended to support firms' foreign business growth. "Such research is typically directed towards supporting production facilities, customizing products to local market demands, and tracking and capitalizing on foreign technological advancements."[64]

The software industry fits the broader pattern of concentration of research and development activities in the industrialized countries depicted in the following table:[65]

Table 3

Geographic Location of Large Firms' Global Patenting Activities, According to Nationality (1985-1990)

Percentage Shares						
	Home	**Abroad**	**Of Which:**			
			U.S.	**Europe**	**Japan**	**Other**
Japan (13)	98.9	1.1	0.8	0.3	-	0.0
U.S. (249)	92.2	7.8	-	6.0	0.5	1.3
Italy (7)	88.1	11.9	5.4	6.2	0.0	0.3
France (26)	86.6	13.4	5.1	7.5	0.3	0.5
Germany (43)	84.7	15.3	10.3	3.8	0.4	0.7

overhead) is $10-12,000 per year).

63. *See id.* at 139 (stating that Texas Instruments' Bangalore subsidiary communicates with the company's advanced information management division in Plano Texas, via satellite).

64. NATIONAL SCIENCE BOARD, *supra* note 9, at 4-44.

65. *See* Patel & Pavit, *supra* note 60, at 302.

Finland (7)	81.7	18.3	1.9	11.4	0.0	4.9
Norway (3)	68.1	31.9	12.6	19.3	0.0	0.0
Canada (17)	66.8	33.2	25.2	7.3	0.3	0.5
Sweden (13)	60.7	39.3	12.5	25.8	0.2	0.8
U.K. (56)	54.9	45.1	35.4	6.7	0.2	2.7
Switzerland (10)	53.0	47.0	19.7	26.1	0.6	0.5
Netherlands (9)	42.1	57.9	26.2	30.5	0.5	0.6
Belgium (4)	36.4	63.6	23.8	39.3	0.0	0.6
All firms (587)	89.0	11.0	4.1	5.6	0.3	0.9

The parenthetical numbers correspond to the number of firms in each of the countries. This table reveals that U.S. and Japanese firms carry out an overwhelming proportion of research and development within their national borders. These countries are extreme examples of the pattern of high concentration of research and development in the industrialized countries. Additionally, only a small fraction of the overseas research and development activities take place in developing countries.

B. EXPLAINING THE TREND: COLLECTIVE LEARNING AND THE MARKET

Software producers concentrate their research and development activities in the U.S. because they assume that it is the most effective way to use their human capital and that it will enhance responsiveness to U.S. clients, which is a high priority in the industry.

The software industry is heavily dependent on human capital to produce the innovations that will allow firms to develop in a highly competitive market.[66] Perhaps the most critical factors of production, the programmers, are mobile from firm to firm and even from country to country, producing a high turnover rate in the software industry. [67] Firms in the U.S. and elsewhere can effectively reach many software technology frontiers by hiring skilled and experienced programmers in a competitive world market.[68] This phenomenon also takes place

66. *See* OWEN W. LINZMAYER, APPLE CONFIDENTIAL: THE REAL STORY OF APPLE COMPUTER INC. 38 (1999).

67. *See id.* (revealing that out of 48 prominent members of Apple's initial development, only three remained in 1998).

68. *See* SIWEK & FURCHTGOTT-ROTH, *supra* note 10, at 149.

in developing countries.[69] Section 5 looks at the challenges that developing countries face due to the U.S. demand for programmers.

Software companies provide generous financial benefits to their employees and engage in aggressive recruiting to secure human capital.[70] "In addition to scouring college campuses for young prospects, Microsoft remains vigilant for opportunities to recruit the best-experienced hands from rival companies."[71] "'Direct sourcing' is what Mike Murray, Microsoft's vice-president for human resources, called the recruiting campaign that would fasten on a software company that was doing technically interesting work."[72] "Microsoft acquired small software companies, not primarily for their customers or for their code, but for their in-house programming assets."[73] "When the best programmers in such companies were the main shareholders, it was often easiest to simply buy the company outright, in effect, providing the talent with the equivalent of a signing bonus."[74]

To maximize the potential of human resources, software companies are organizationally integrated.[75] At the heart of the

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69. *See* Bryant, *supra* note 23, at 382 (stating that the constant theme in his interviews with Brazilian business leaders, government policy makers, attorneys, and scientific researchers was that most companies lost their proprietary technology through key technical employees hired away by competing firms offering higher employee salaries. The "gypsy career" is viewed as a cost of doing business in Brazil. The situation occurs when technical employees aspire to learn the technology of a company so as to position themselves to be hired away by competitors at attractive salaries. This practice increases salaries as companies seek to both attract and retain skilled employees).

70. *See* STROSS, *supra* note 1, at 24 (stating that the most important employee benefit was perhaps the one that made Microsoft a financially comfortable place to work: ownership of Microsoft stock among employees. The company promoted employee stock purchases with a 15% discount and offered stock options to some extent to all salaried employees who worked at the company for one year).

71. *Id.* at 42.

72. *Id.*

73. *Id.*

74. *Id.*

75. *See* WILLIAM LAZONICK, ORGANIZATION AND TECHNOLOGY IN CAPITALIST DEVELOPMENT 249 (1992) (defining organizational integration as a set of ongoing relationships that socializes participants in a complex division of labor to apply their skills and efforts to achieve common goals. The foundation of the socialization process that achieves organizational integration is "membership": the inclusion of the individual or group into the organization with all the rights and responsibilities that membership entails).

software company is the core design and development group, responsible for designing and controlling the architectural standard.[76] "The group is kept as small as possible. A radiating series of development groups surround the core group."[77]

What do software companies seek to achieve through organizational integration? Companies in the information industry are dependent on collective learning, which enables the planned coordination of specialized divisions of labor to develop complex technology and generate productivity.[78] Without collective learning, specialized individuals cannot enhance their skills through communication with each other. Management's role is to ensure the concentration of continuous, cumulative and collective learning.[79] Ultimately, organizational integration acts as a strong disincentive for technology transfer from the company's central office to its branch in the host country because transfers can weaken collective learning.[80] Socialization requires human interaction. Geographical dispersion acts as a barrier to the socialization patterns central to organizational integration.

Besides organizational integration, market considerations also reinforce the concentration of research and development activities. Because the U.S. software market is extremely competitive, success in the U.S. is more likely to translate into success abroad than vice versa.[81] With a large installed base of both recent generation computers and a wide selection of up-to-date computer software, U.S. software users are sophisticated and discriminating in their choice of products.[82] One result of U.S. testing of new products is that purchasers in other countries sometimes look to product success in the U.S. as a basis for licensing.[83] Consequently, the direction of technology

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76. *See* CHARLES H. FERGUSON & CHARLES R. MORRIS, COMPUTER WARS. HOW THE WEST CAN WIN IN A POST-IBM WORLD 175 (1993).

77. *Id.*

78. *See* LAZONICK, *supra* note 75, at 255.

79. *See id.*

80. *See* Patel & Pavitt, *supra* note 60, at 303 (arguing that the rapid product development times in Japanese firms have been achieved from an almost exclusively Japanese base, while the strongly globalized research and development activities of the Dutch Philips company have slowed down product development).

81. *See* SIWEK & FURCHTGOTT-ROTH, *supra* note 10, at 90.

82. *See id.*

83. *See id.*

diffusion for computer software is from the U.S. to the rest of the world.[84]

The gravitational pull of the U.S. market makes it more difficult for computer software companies to move operations offshore. Product development in software is very closely linked to customer requirements, and customer requirements for the largest market are most easily monitored in the U.S. Taking advantage of new technologies may also be easier in the U.S. than elsewhere. In the competitive races to bring new products and services to the market, any cost savings from offshore operations must be weighed against delay in introducing new products.[85]

Jose Dominguez, President of South Tech Systems is reluctant to outsource more than a fraction of the company's programming. "Even though I'm happy with the work they're doing (Indian and Armenian programmers based in their respective countries) it's hard to oversee a project over the Internet. You don't have full control."[86] He also pointed out that communication over the Web has increased the opportunities for misunderstandings, and the time difference between the U.S. and Asia makes it difficult to talk by telephone.[87]

Shneyderman, of Game-Colony.com, has fewer reservations about these international arrangements.[88] He had planned on staffing his company with local software developers mainly because "it's easier to oversee employees working in the same office than in one 11 time zones away."[89] However, the few qualified candidates he found wanted $90,000 a year, a signing bonus and stock options, which was far more than he could afford.[90] Shneyderman decided to outsource a substantial portion of his firm's high-tech work overseas, turning to his homeland. His five Russian programmers earn about $18,000 a year each.[91]

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84. *See id.* at 91.
85. *See id.* at 94.
86. Marc Ballon, *US High-Tech Jobs Going Abroad*, L.A. TIMES, Apr. 24, 2000, at C4.
87. *See id.*
88. *See id.*
89. *Id.*
90. *See id.*
91. *See id.*

C. HOW SOFTWARE COMPANIES VIEW INTELLECTUAL PROPERTY PROTECTION

Before the 1980s, the large U.S. companies in the information industry had a casual view of intellectual property protection.[92] Their lax patent policing was an outgrowth of the strong U.S. technology position in the 1950s and 1960s,[93] a period in which broad cross-licensing was an efficient way to avoid patent battles when the information industry was divided among a few major players such as AT&T, IBM, and RCA; each with strong research laboratories.[94] In accordance with the prevailing attitudes, Apple allowed Microsoft access to its operating system technology, and Intel's broad licensing to companies like Texas Instruments opened the door to widespread cloning of its most advanced chips. The view that software should be given away was not uncommon in the industry.[95]

Since the 1980s, the attitudes towards intellectual property protection in the information industry have shifted from relative casualness to greater awareness that intellectual property protection and licensing practices are key elements of a company's technological strategy.[96] Currently, companies believe that licenses must be managed with a careful eye on the future, and whenever possible, be both specific and modular, in contrast to the broad cross-licenses of the past.[97] The growing importance of intellectual property protection is reflected in the dramatic increase in patents in the information industry.[98]

Intellectual property protection became more relevant with

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92. *See* FERGUSON & MORRIS, *supra* note 76, at 155.

93. *See id.*

94. *See id.*

95. *See* LINZMAYER, *supra* note 66, at 49 (stating that even today Bill Gates is remembered as the 1970s outspoken advocate for commercializing the distribution of software in order to encourage software developers to continue to invest their labor. Gates had heated exchanges with Jim Warren of the People's Computer Company among others, who Gates charged with ripping off software without payment).

96. *See* FERGUSON & MORRIS, *supra* note 76, at 157.

97. *See id.*

98. *See* U.S. Patents and Trademarks Office, *Patent Counts by Class by Year 1/1977-12/31/1998* (visited Feb 10, 2000) <http://www.uspto.gov/web/offices/ac/ido/oeip/taf/pat_tr98.htm> (showing that the total number of patents in computer graphics, information processing systems, data processing and computers, and digital processing systems was 1,266 in 1979, 8,748 in 1989, and 31,212 in 1998).

the multiplication of software producers.[99] The rise of new competitors upset the reasoning of dominant companies in the information industry, because the direction of licensing was unilateral and in some instances the emerging software companies simply "grabbed" any available technology.[100] In a crowded market, even the onetime "pirates" became zealous guardians of their intellectual property, particularly when their revenues dropped, as suggested by the experience of Apple.[101]

While software company investments are not highly sensitive to the quality of enforcement of intellectual property rights, the software industry does have a stake in improved enforcement of these rights because their infringement affects their research and development costs in the U.S. The majority of software companies take four years or longer to achieve profitability. Research supported by the Inter-American Development Bank reveals that fewer than one third of software developers with revenues of $10 million or less will accept a development project that will not generate significant revenues within two years.[102] Illegal copying can have a dramatic impact on the financial well-being of these companies.

The following table ranks the ten countries with the highest dollar losses due to software piracy[103]:

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99. *See* NATIONAL SCIENCE BOARD, SCIENCE AND ENGINEERING INDICATORS, APPENDIX 295 (1996) (revealing that between 1960 and 1994, 7,661 software companies were formed in the U.S.; of these, 5,196 were established after 1980).

100. *See* LINZMAYER, *supra* note 66, at 72 (stating that Apple's Steve Jobs had direct oversight of the Macintosh project. Jobs referred to his group as "pirates", and in keeping with that spirit began systematically raiding other projects, some of which were even under Apple tutelage, for key technologies. A member of the team stated that, "we looked for any place where we could beg, borrow or steal code").

101. *See id.* at 202-03 (stating that after Gilbert F. Amelio became Chairman and CEO of Apple in February, 1995, he favored licensing Apple's technology and within two weeks of being appointed initiated licensing the system 7.5X and Copland to the Motorola Computer Group. In late May, UMAX Data Systems Inc., a Taiwanese manufacturer of scanners purchased a Mac License. Apple net sales peaked in 1995 at $11 billion and steadily declined to $6 billion in 1998. Steve Jobs replaced Amelio in 1997, who strongly opposed licensing and referred to Mac cloners as "leeches").

102. *See* INTER-AMERICAN DEVELOPMENT BANK, *supra* note 16, at 20.

103. *See* INTERNATIONAL PLANNING AND RESEARCH CORPORATION, 1997, GLOBAL SOFTWARE PIRACY REPORT 3 (1998).

Table 4

Ten Countries with Highest Losses Due to Software Piracy
(U.S. Dollars)

Country	**Total dollar loss**	**Piracy rate**
U.S.	$2.8 billion	27%
China	$1.4 billion	96%
Japan	$0.8 billion	32%
Korea	$0.6 billion	67%
Germany	$0.5 billion	33%
France	$0.4 billion	44%
Brazil	$0.4 billion	62%
Italy	$0.3 billion	43%
Canada	$0.3 billion	39%
U.K.	$0.3 billion	31%

Total losses for these countries were $7.3 billion, or sixty-seven percent of worldwide losses. Even in the country with the lowest rate of piracy, the U.S., more than one in four applications are pirated.[104]

At the regional level, North America, Asia-Pacific, and Western Europe account for eighty percent of the total revenue losses of the software industry. The Asia-Pacific region has the second highest dollar losses, after North America. In the Asia-Pacific region, total losses of $3 billion were estimated for 1998, down from $3.9 billion in 1997.[105] Latin American countries with the largest revenue losses in 1998 include Brazil ($367 million), Mexico ($147 million), and Argentina ($124 million). Combined, these three countries represent sixty percent of the region's dollar losses, corresponding to the sixty-five percent of

104. *See id.* at 10 (stating that the difference between software applications installed (demand) and software applications legally shipped (supply) equals the estimate of software applications pirated. These were calculated by country for 1997. The piracy rate was defined as the amount of software pirated as a percent of total software installed in 1997 for each country. By using the average price information from the collected data, the legal and pirated software revenue was calculated. This is a wholesale price estimate weighed by the amount of shipments within each software application category).

105. *See id.* at 3 (stating that the countries with the highest rates in the Asia-Pacific region were Vietnam (97%), China (95%), and Indonesia (92%). Countries with the highest dollar losses were China ($1.2 billion), Japan ($597 million), and Korea ($198 million)).

the business software market these countries represent. While the overall piracy rate in Latin America declined by two percentage points in 1998, more than 17.7 million applications were pirated in the region during 1998, resulting in an overall piracy rate of sixty-two percent.[106]

Section 2.5 provided evidence in support of the view that there is a weak relationship between the enforcement of intellectual property rights of the software industry and overseas investment in software research and development. This section has sought to explain that software companies do have a stake in improved enforcement of these rights. For the companies, improved enforcement has the objective of offsetting investors' inability to realize sufficient benefits from their investments in new software technology; which is the underlying rationale of patents and copyrights as policy instruments.[107] International efforts to strengthen enforcement of intellectual property rights are guided by the same logic.

The next section will argue that developing countries have participated in international efforts to strengthen intellectual property protection by improving the rules and their enforcement with dramatically different expectations than the U.S. software companies. The governments of developing countries are assuming that their efforts to improve intellectual property protection will be rewarded with overseas investments. The absence of these investments contributes to their low political commitment to improve enforcement of intellectual property rights. This makes international efforts particularly vulnerable because their cornerstone is public enforcement of rights by local authorities. It is plausible that these limitations can be overcome if developing countries believe that enforcement of intellectual property rights will stimulate their local software industries. International actors can take steps in this direction by providing assistance to local software suppliers to defend their intellectual property rights and develop associations of software suppliers.

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106. *See* INTER-AMERICAN DEVELOPMENT BANK, *supra* note 16, at 26 (stating that the countries with the highest piracy rates continue to be El Salvador and Bolivia (both with 87%), followed by Paraguay and Guatemala (each with 85%). Brazil, the largest country in the region has a piracy rate of 61%, falling just one percentage point from 62% in 1997. The region remains well above the 25% piracy rate target set by the Inter-American Development Bank).

107. *See* FREDERIK M. SCHERER, NEW PERSPECTIVES ON ECONOMIC GROWTH AND TECHNOLOGICAL INNOVATION 59 (1999).

III. HOW THE WEAK RELATIONSHIP BETWEEN OVERSEAS INVESTMENTS IN SOFTWARE RESEARCH AND DEVELOPMENT AND THE ENFORCEMENT OF COPYRIGHT, TRADE SECRET, AND TRADEMARK RIGHTS AFFECTS OVERSEAS COMMITMENT TO IMPROVE ENFORCEMENT

This section explains why developing countries are not fully committed to improving enforcement of copyright, trademark, and trade secret protection. It also highlights some of the strategies followed by some of these countries to avoid improving enforcement and comments on their consequences.

Multilateral institutions[108] and policymakers in developing countries, such as Brazil[109] and Mexico,[110] expected that improved intellectual property protection would increase investment flows in the software and other high-tech industries. To date, there is little evidence supporting the responsiveness of investment to this signal, but there is a widespread and growing belief in its importance. Even poor countries with limited technical capabilities, including Indonesia, the Philippines, and Vietnam unilaterally strengthened their enforcement of intellectual property rights in the past decade.[111]

Posner argues that economic constraints lead governments to establish enforcement priorities.[112] It follows that governments will intensify efforts in the industries where the economic benefits of enforcement improvements are significant.

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108. *See* INTER-AMERICAN DEVELOPMENT BANK, *supra* note 16, at 20 (stating that local software publishers are unwilling to invest in research and development when there is a significant amount of software piracy. Strong national intellectual property protection creates an investment-friendly environment that in turn promotes research and development. An important obstacle to the globalization of software research and development is the ineffective protection of intellectual property)

109. *See* Bryant, *supra* note 23, at 403 (stating that the Cardoso administration sought to stimulate investment by reducing trade barriers and introducing legislation to the Brazilian Congress requiring heightened protection of patent, trademark, copyright, and trade secret rights).

110. *See* George Y. Gonzalez, *Symposium on the North American Free Trade Agreement: An Analysis of the Legal Implications of the Intellectual Property Provisions of the North American Free Trade Agreement,* 34 HARV. INT'L L.J. 305, 316 (1993) (arguing that increased foreign investment was a primary goal of 1991 legislative changes to provide intellectual property protection to software).

111. *See* Maskus, *supra* note 58, at 138.

112. *See* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 564 (1986).

Software protection is not a high priority for local authorities because improved enforcement of the rights of the software industry will not stimulate overseas investments in research and development in their home countries. Governments might still have the economic incentive of protecting software to avoid U.S. trade sanctions,[113] or to obtain a favorable U.S. response to a policy initiative, such as NAFTA ratification in the case of Mexico,[114] or WTO membership for China.[115] However, these incentives are short lived and lead to an inconsistent pattern of improvements in intellectual property protection.

Past experience reveals that without the benefits of overseas investments, developing countries tend to maneuver around U.S. efforts to improve intellectual property protection. The U.S.T.R. review process relies heavily on changes in formal rules.[116] Political commitment is weak in the absence of overseas investments, and policymakers from developing countries often resort to formal rule changes to prevent trade sanctions with minimal efforts to improve enforcement. Though Brazil,[117] China,[118] Mexico,[119] Thailand, and Taiwan

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113. *See* Kim Newby, *The Effectiveness of Special 301 in Creating Long Term Protection for US Companies Overseas,* 21 SYRACUSE J. INT'L L. & COM. 29, 47 (1995) (stating that the BSA worked with the Indonesian government in a raid on printers. The raids resulted in confiscation of more than 17,000 illegally printed computer software manuals. The reason for the cooperation was that the U.S.T.R. was hinting at upgrading Indonesia on the Special 301 lists).

114. *See* Amy R. Edge, *Preventing Software Piracy Through Regional Trade Agreements: The Mexican Example*, 29 N.C. J. INT'L LAW & COM. 175, 198-99 (1994) (stating that during the NAFTA negotiations, the Mexican government increased protection for software to assure U.S. manufacturers of its good faith. Several different steps were taken. First, the government and the National Association of Computer Program Industry (ANIPCO), the domestic group that represents the interests of software producers, began a campaign to educate the public about software piracy. Second, the government established a special division within the Attorney General's office to investigate companies suspected of engaging in software piracy. Finally, the government, in conjunction with ANIPCO, began raiding the offices of companies, which were believed to be using pirated software).

115. *See* Fonda Y. Duvanel, *The Evolution and Enforcement of Computer Software Copyright in the People's Republic of China,* 16 N.Y.L. SCH. J. INT'L & COMP. L. 337, 403 (1996) (suggesting that the desire of the People's Republic of China to be admitted to the WTO creates strong incentives for this country to begin to fully enforce its copyright laws).

116. *See* United States Trade Representative, *supra* note 17 (revealing that from May of 1995 to April of 1996, the U.S.T.R. reported sixty developments in intellectual property rights. Only nine of these developments focus on enforcement of rights. The remaining are changes in regulations).

117. *See* Bryant, *supra* note 23, at 376-77 (arguing that the high rate of

have engaged in formal rule changes, their commitment to enforcement is questionable:

(1) According to U.S. Senator Max Baucus, the result of trade negotiations with China was "the most important Special 301 victory to date."[120] However, software piracy in China generated losses for the U.S. industry of $1.4 billion in 1997, and the piracy rate was ninety-six percent.[121]

(2) In April of 1995, Brazil was placed on an intermediary watch list.[122] The U.S.T.R. felt, judging from its failure to take a stringent stance towards Brazil, that the country was making excellent strides towards strengthening its protection of intellectual property rights, and no further U.S. action was necessary.[123] This view is contradicted by a recent study, which revealed that Brazil is among the ten countries with the highest losses due to piracy.[124]

(3) In 1997, sixty-two percent of all software applications in use in Mexico were counterfeit, a significantly higher rate than the forty percent world piracy figure for that year.[125]

(4) Thailand was listed as a Priority Watch Country in 1990 and 1991. This led the government of Thailand to amend its laws on intellectual property to meet international standards. Despite the formal rule changes, losses from pirated software cost U.S. companies more than $25 million in 1991, $49 million in 1992, and $75 million in 1993. The piracy rate in Thailand was estimated to be around eighty-four percent in 1997,[126] more than double the corresponding world

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computer software piracy does not reflect an absence of legislation. The 1987 software law provides the judicial means, at least on paper, by which software publishers may combat violations of their product copyright. This law provides for fines as well as criminal prosecution).

118. *See* Ansson, *supra* note 21, at 7-8 (stating that China has promulgated numerous rules to heighten intellectual property protection, including: (1) the Technological Contract Law of China; (2) the Regulation on the Protection of Computer Software; (3) the Law of Scientific and Technological Progress of China; and (4) the Law on Combating Unfair Competition).

119. Established copyright protection for software in 1991 and joined NAFTA in 1993.

120. Newby, *supra* note 113, at 42-43.

121. *See* INTERNATIONAL PLANNING AND RESEARCH CORPORATION, *supra* note 103, at 6.

122. *See* Bryant, *supra* note 23, at 411.

123. *See id.* at 410-11.

124. *See* INTERNATIONAL PLANNING AND RESEARCH CORPORATION, *supra* note 103, at 3.

125. *See id.* at 6.

126. *See id.*

figure.

(5) Taiwan was taken off the priority watch list in May 1991, after authorities promised to enact intellectual property legislation and to establish an unprecedented inspection system aimed at stopping counterfeit software. By 1992, however, Taiwan had not made sufficient efforts to abide by the 1989 agreement and was reinstated in the priority watch list.[127] A recent study placed Taiwan's software piracy rate at sixty-three percent in 1997.[128] This is about the same rate as Mexico, another Special 301 target.

BSA raids face the same shortcomings as the threat of trade sanctions. It would be expected that as the threat of trade sanctions come and go, so does the motivation of local authorities to commit to BSA raids on infringers. An additional setback of the raids is that they are not cost effective.[129] An ongoing program in China suggests that the BSA and authorities from both the U.S. and the host country can strengthen international collaboration to verify the legality of software.[130] The preliminary results of the system are not available yet, however, it shows promise to reduce administrative barriers to the enforcement of intellectual property rights in developing countries. Currently, China is seeking WTO membership, which might be influencing the government's commitment to this effort.

This section has highlighted some of the consequences of the lack of political commitment in developing countries to

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127. *See* Newby, *supra* note 113, at 39.

128. *See* INTERNATIONAL PLANNING AND RESEARCH CORPORATION, *supra* note 103, at 6.

129. *See* Duvanel, *supra* note 115, at 391 (arguing that a raid against five Beijing-based computer companies for copyright infringement took months of preparation and thousands of dollars to mount. Because few software copyright owners would be able to conduct or finance these investigations, it is likely that most foreign software copyright owners will have to rely on the courts to identify and obtain evidence sufficient to establish infringements of their rights).

130. *See* Ansson, *supra* note 21, at 13 (stating that in late April of 1997, the United States Information Technology Office finalized a contract to perform verification services in China on behalf of the U.S. software industry. The software title verification system will allow software companies from the U.S. to monitor Chinese CD-ROM plants. Under the system, requests will be reviewed by the National Copyright Administration in the U.S. and then processed through the Software Title Verification Office. The BSA will then determine whether a particular order is legitimate, with illegitimate orders triggering investigations and enforcement procedures by the Chinese government).

improved enforcement of intellectual property rights. The weak relationship between overseas investment in research and development and improvement in enforcing intellectual property rights affects this commitment, producing a pattern of short-term policies often designed to reduce the threat of trade sanctions. Despite technological innovations,[131] software companies still depend on public enforcement to protect their intellectual property rights. Sustained efforts to improve enforcement depend on long-term economic gains for developing countries. The next section explores the extent and conditions under which local software suppliers can play a role in achieving sustained improvements in the enforcement of intellectual property rights and how international policies can be aligned with the interests of these actors.

IV. INCENTIVES TO IMPROVE ENFORCEMENT

If improved enforcement of copyright, trademark, and trade secret rights is not a direct determinant of offshore software investment, then what incentives do developing countries have to protect software from piracy? This section will argue that developing a local software industry provides the incentive that local authorities need to improve enforcement of copyright, trade secret, and trademark protection. Local software suppliers support improved enforcement of copyright, trade secret, and trademark protection following their economic interests. International actors can contribute to boosting the position of these suppliers so that they can become effective promoters of enforcement. The success of these efforts will be more likely if local authorities adopt policies that encourage the development of local software suppliers. Section A discusses how software piracy affects local software suppliers. The next section highlights strategies that the BSA and U.S. software

131. *See* Kory D. Christensen, *Fighting Software Piracy in Cyberspace: Legal and Technical Solutions*, 28 LAW & POLICY IN INTERNATIONAL BUSINESS 435, 467-68 (1997) (stating that companies have explored the use of technological alternatives such as scrambling readable text in their programs to make it unreadable (encryption). Until recently, the processing overhead required to unscramble text (decryption) in real time was prohibitive. With the development of faster computers, the science of cryptography can now be applied to many new applications. One such application is encrypting computer programs to protect them from piracy. However, the bulk of commercial software is not encrypted).

companies can follow to assist local company efforts to improve enforcement. Finally, Section 5.3 explores domestic policy orientations that overseas authorities can follow to contribute to the development of a local software industry by addressing the needs of existing local suppliers.

A. THE IMPACT OF PIRACY ON LOCAL SOFTWARE SUPPLIERS

Recent studies assess the impact of software piracy on sales, jobs, and tax revenues in developing countries.[132] This diffuse economic impact is the underlying rationale to improve enforcement. However, this impact needs to be translated into specific economic shortcomings for the domestic actors that are capable of promoting stronger enforcement, such as the domestic software producers. What makes these actors potential partners for international actors seeking to improve overseas intellectual property protection is that they are particularly vulnerable to counterfeiting and they are already active promoters of stronger enforcement of intellectual property rights and are improving their organization and engaging in litigation.

Even though piracy affects all parties in the software distribution channel, the experiences of China[133] and Mexico[134]

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132. *See* INTER-AMERICAN DEVELOPMENT BANK, *supra* note 16, at 1-3 (estimating that the packaged software industry generated $3.54 billion in sales, 137,345 jobs and $1.24 billion in tax revenues throughout Latin America in 1998. Based on average market growth projections of 18% per year, the Bank predicts that this segment of the information technology industry will produce total employment of 193,735 and fiscal revenues of $2.40 billion by 2002. Complete eradication of software piracy may be difficult, but a reduction from 62% to 25% would have significant "multiplier" effects on the economic contribution of the packaged software industry. If the piracy rate in Latin America had been reduced to 25% in 1998, the economic contribution of this sector would have been approximately 150% greater. There would have been an estimated $5.32 billion more sales, 206,391 more jobs and $1.86 billion more in annual tax revenues throughout the Latin American economies).

133. *See* Bien, *supra* note 22, at 32-39 (detailing how the Wang Ma Computer Company obtained the rights to the five-stroke input method for Chinese characters. In accordance with this method, selected keys represent basic brush strokes. By typing the brush stroke keys in a specific order, the desired character appears. A skilled user can type up to 250 characters per minute compared to 15-25 using pinyin. China's ineffective enforcement of copyright law encouraged other Chinese software companies, as well as Hope, Stone and Richsite to incorporate the five-stroke method in their programs without an agreement with Wang Ma, placing this company on the verge of bankruptcy).

reveal that it may have its greatest impact on the growth and development of local software developers and publishers. Since they cannot compete against pirated software, it is very difficult for local firms to develop and launch new software packages in markets where piracy is rampant.[135]

B. INTERNATIONAL EFFORTS TO ASSIST LOCAL SOFTWARE ` SUPPLIERS AGAINST SOFTWARE PIRACY

Many nascent software companies in developing countries have modest resources and cannot defend their rights in court against piracy. In contrast, the BSA initiates litigation around the world in defense of its member's proprietary rights in their creations. The BSA efforts have proven successful.[136] The BSA could broaden their efforts and finance litigation on behalf of domestic software companies seeking to stop piracy.

How would defending local companies further the interests of the U.S. software industry? In countries facing rampant piracy, it is particularly important that courts set precedents of intellectual property protection, regardless of the nationality of the software company. This contributes to changes in the attitudes towards intellectual property protection. In addition, BSA support for local software companies is a way to get around the nationalist bias found in some courts that has proven to be a barrier to the U.S. software industry.[137]

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134. *See* Edge, *supra* note 114, at 175 (stating that the Mexican domestic software industry suffered losses estimated between $250 and $260 million in 1992, due to the illegal copying of software. The value of the legal software market was estimated at $210 million in 1991, thus, losses suffered were greater than the market's entire value).

135. *See* INTER-AMERICAN DEVELOPMENT BANK, *supra* note 16, at 23.

136. *See* Bryant, *supra* note 23, at 412 (stating that the Court of Appeals of the State of Sao Paulo upheld a previous decision favorable to a BSA member). The Court of Appeals decision represented the first civil appellate decision in Brazil regarding computer software. *See id.* at n.289.

137. *See generally* Bien, *supra* note 22 (stating that in the case of China, U.S. software companies have faced problems of unwillingness of courts to carry out procedures and to award more than symbolic amounts in damages, as exemplified in three particular court disputes. *IFPI v. Huale* showed how some Chinese courts condone duplicitous attempts to reject culpability. The defendants accused of copyright infringement claimed they were not guilty because Taiwanese criminals were using them. The courts found their explanation satisfactory and pressured IFPI to accept it as well. *Suntendy v. Taisen* revealed how some Chinese courts use ambiguities of the damage provisions in China's copyright laws to avoid levying substantial penalties. Beijing's Intermediate People's Court awarded damages based on miniscule

However, efforts to change attitudes towards enforcement of intellectual property rights through litigation may be perceived as predatory by the population. Additionally, their immediate impact is circumscribed to particular disputes. An alternative to litigation is to strengthen the cooperation between the BSA and local associations with similar goals, such as the Taiwanese Information Product Anti-Piracy Union. The Union is aimed at intensifying crackdowns on counterfeit computer products and is patterned after the BSA. At present, more than thirty Taiwanese computer software manufacturers have joined the Union. The BSA and local associations can jointly encourage authorities to strengthen enforcement of intellectual property rights. In support of this effort, some BSA resources could be diverted from engaging investigators and attorneys to police the world to financing work with domestic organizations to meet their local needs as well as targeting U.S. Alliance member concerns.

In Western Europe, the BSA regularly organizes, conducts, coordinates, and participates in intellectual property training for courts, prosecutors, and specialized police units at the BSA's expense. In a recent report, the BSA stated that it was "interested in and willing to participate in the preparation and conduct of further such training programs in the future. Because the copyright sectors' problems differ substantially, training modules from each of the major copyright industries, particularly the software industry, are needed."[138] Similar undertakings can be carried out in developing countries. This would allow the communities to see the BSA engaged in activities other than raids and litigation. Local software supplier associations should monitor progress and evaluate these training programs to avoid nationalist sentiments stemming from direct BSA involvement.

The protection of U.S. research and development spending against piracy can be improved if local software suppliers

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amounts. Suntendy sought 3.5 million-Yuan for its economic losses due to software misappropriation yet received only 200 thousand-Yuan. *Microsoft v. Juren* highlighted the problems of damage assessment and documents the obstacles that foreign litigants face. Microsoft, Lotus and Autodesk filed a complaint with the Beijing Number One Intermediate Intellectual Property People's Court on October 12, 1994 against Juren who was accused of frequently giving counterfeit software to customers who had purchased a personal computer. The Court acted irregularly and delayed conducting raids on the infringer's facilities. The actual damages received by plaintiffs amounted to $48 thousand dollars, well below the attorneys' fees).

138. BUSINESS SOFTWARE ALLIANCE, *supra* note 56, at 94.

become promoters of improved intellectual property enforcement. The effectiveness of these actors depends on their financial well-being. These companies are eager to design and develop software for distribution in the U.S. market.[139] U.S. companies can support these local suppliers by establishing joint ventures between U.S. and local firms or outsourcing of U.S. based projects to local contractors.[140]

C. POLICY ORIENTATIONS TO DEVELOP A SOFTWARE INDUSTRY

At the domestic level, governments need to focus on the requirements of software suppliers, which fall into three basic categories: (1) human capital; (2) adequate business practices; and (3) financial incentives for research and development.

Human capital in the software industry takes the form of science and engineering graduates.[141] Without adequate incentives, programmers will seek employment in the U.S.[142] The following table highlights the extent of the problem:[143]

Table 5

Percentage of Foreign-born 1992 U.S. Doctoral Recipients from Selected Countries Planning to Remain in the U.S.

National origin	**Engineering degrees**
China	87.1
Taiwan	50.2
Japan	24.0
South Korea	29.9
India	82.9

139. The U.S. market is relevant to the local software suppliers because: a) its size can generate attractive revenues for offshore software producers, and, b) it is highly competitive, which can in turn stimulate improved quality of offshore produced software.

140. *See* SIWEK & FURCHTGOTT-ROTH, *supra* note 10, at 137 (presenting an overview of these arrangements in India).

141. *See* Patel & Pavitt, *supra* note 60, at 314 (arguing that countries with a strong endowment of science and engineering graduates, but a badly educated workforce can specialize in fields like drugs and software, where the skills of the general workforce are not critical).

142. *See id.* at 137 (revealing that a typical programmer in India with three years of experience might earn $200; approximately ten times less than his or her U.S. counterpart).

143. *See* NATIONAL SCIENCE BOARD, *supra* note 9, at 2-34.

United Kingdom	82.4
Canada	58.7
Germany	55.6
France	40.0
Spain	50.0

U.S. companies have had openings for more than 1.6 million information technology workers in the year 2000. Less than half of them were filled.[144] Current U.S. immigration policy fosters the retention of computer scientists to meet the demand.[145] U.S. analysts are encouraged by these developments and perceive a functional need in the U.S. for the foreign-born software developers.[146] In 1993, foreign students obtained thirty-four percent of the master's degrees in computer science and forty-four percent of the doctoral degrees in this field. About thirty percent of the graduates received firm offers to remain in the U.S.[147] The retention rates for students from India and the People's Republic of China were well above average, and the combined immigration from the two countries accounted for 37.9 percent of all science and technology immigrants.[148] This is particularly ominous for these two countries because they are trying to develop local software industries for which English-trained programmers are valuable assets.[149] This problem is of concern in the Indian information industry.[150]

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144. *See* Ballon, *supra* note 86, at C1.

145. *See* NATIONAL SCIENCE BOARD, *supra* note 9, at 2-34 (revealing that despite an overall decline in immigration to the U.S. in 1993, the admission of scientists and engineers continued to rise. According to INS data, 23,534 scientists and engineers were admitted to the U.S. on permanent visas in 1993. Mathematical scientist and computer specialists accounted for nearly half of the permanent visas).

146. *See* FERGUSON, *supra* note 76, at 255 (arguing that the immigration service frequently forces highly qualified foreigners doing important work to leave the country when their visas expire. From the admittedly narrow perspective of U.S. technological self-interest, there would be great dividends from a broad policy of skill-based waivers of standard policies and quotas).

147. *See* NATIONAL SCIENCE BOARD, *supra* note 9, at xxxix.

148. *See id.* at 2-34.

149. *See* SIWEK & FURCHTGOTT-ROTH, *supra* note 10, at 94 (stating that most software continues to be English-based and firms with all operations in English may have more of an advantage in the U.S. market than a firm with some operations in another language. Customers find only English-language computer interface but also customer assistance, reference manuals and all correspondence with the company in English).

150. *See* Ganesh Natarajan, *The Software Product Odyssey*, COMPUTERS

The recent opinions of representatives of software companies such as Focus Software International and GoldMine Software Corp. suggest that U.S. immigration policy can have an impact on overseas investments in research and development. The existing target of 115,000 special visas for skilled foreign workers is short of industry expectations. This is pushing software companies to hire overseas subcontractors.[151] Increased demand of overseas software design and development can ameliorate the immigration trend. As opportunities to work at the technological cutting edge expand in newly industrialized and industrializing countries, they will likely affect the ability of the U.S. to attract and retain top science and engineering talent currently readily available to U.S. businesses, universities, and the government.[152] The indispensable conditions to stimulate local demand for talent include improvements in business practices of local suppliers and the development of a financial structure to fund research and development.

For the most part, offshore subcontractors have been inefficient in promoting their services, both within their own countries and abroad.[153] The subcontractors that manage to get the attention of U.S. companies find that offshore investments are influenced by their (1) positive and negative corporate characteristics; (2) methodologies; (3) management philosophies; (4) ethical standards; (5) facilities; and (6) financial stability.[154] U.S. companies that have hired Indian software development firms are more concerned with security and communication issues than with technical competence, cost, quality, or productivity.[155]

The majority of Indian software companies do not have any direct sales force and thus act as subcontractors to software contractors or middlemen in the marketplace. They have

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TODAY, Oct. 1, 1997 (stating that the current generation of trained professionals clearly prefers the promise of immediate riches and status that beckons them from the U.S. and other global destinations. While the manpower supply problem may still be resolved with students from the private training institutions, the difficulties of retaining and motivating talent will continue to plague the industry, particularly the startups, for the foreseeable future).

151. See Ballon, *supra* note 86, at C4.

152. *See* NATIONAL SCIENCE BOARD, *supra* note 9, at 6-30.

153. *See* INTERNATIONAL DATA CORPORATION, *supra* note 40, at 4.

154. *See id.* at 7.

155. *See id.* at 6.

almost no brand equity in the marketplace. Rarely are they in touch with the ultimate customer. Thus, they are not able to predict their future revenues and are at the mercy of the middlemen who will replace them if they find a cheaper alternative. The current sales model for the offshore work results in such low margins for the offshore operations that very few companies can make major investments in sales, infrastructure, training, technology, or tools. The Chairman of Infosys Technologies Ltd., Bangalore stated that the inability to invest adequately in these areas by Indian subcontractors is likely to render them unfit for competition in the international marketplace.[156]

Government spending is a key stimulant of research and development in the U.S. and in other industrialized countries. In addition to providing more resources for research and development than Canada, the United Kingdom, France, Germany, and Japan combined, the U.S. government is a major purchaser of software.[157] Corporate spending on research and development has also been instrumental in the development of the U.S. information industry. IBM[158] and Microsoft[159] provide clear examples of company commitment to research and development. The following table presents the top twenty information technology firms worldwide by research and development intensity, measured in terms of research and

156. *See* N.R. Narayana Murthy, *Can We Make Indian MNCs?*, COMPUTERS TODAY, July 19, 1998, at 112.

157. *See* SIWEK & FURCHTGOTT-ROTH, *supra* note 10, at 95 (revealing that the U.S. government remains a major purchaser of software, accounting for an estimated 21% of software sales in 1991. Government demand has particularly helped U.S. firms. Although federal, state and local governments do not generally prohibit licensing foreign generated software, they may still tend to favor U.S. firms in government contracting, particularly for security related projects. With more than 20% of the U.S. market, government contracts represent a significant portion of all software business).

158. *See* FERGUSON *supra* note 76, at 5 (stating that when Tom Watson Jr. took control of IBM in the mid-1950s, he consciously set out to push the company into the newest electronic technologies. He recruited Emanuel Piore, head of the office of naval research, as chief scientist, and increased research spending from about 15% of net income in the 1940's to 35% in the 1950s and to 50% by the 1960s and 1970s).

159. *See* STROSS, *supra* note 1, at 128 (highlighting how stock analysts in the 1980s noticed that Microsoft, though not the largest software company, led the industry in research and development. Even when Microsoft's growth seemed to slow, research and development were protected. In 1986 for example, more than one fourth of all new hires were assigned to research and development projects).

development spending as a percentage of sales:[160]

Table 6

Research and Development Spending of the Top Ten Information Technology Firms

Firm	**Country of origin**	**R&D spending as % of sales**
Adobe Systems	U.S.	18.2%
Cray Research	U.S.	18.2%
Novell	U.S.	18.0%
Advanced Micro Devices	U.S.	16.4%
Lotus Development	U.S.	16.4%
SAP	Germany	16.3%
Ericsson	Sweden	15.3%
Northern Telecom	Canada	14.8%
Microsoft	U.S.	14.5%
Analog Devices	U.S.	14.3%
Tandem Computers	U.S.	14.2%
DSC Communications	U.S.	13.4%
National Semiconductor	U.S.	11.9%
Silicon Graphics	U.S.	11.1%
Storage Technology	U.S.	10.5%
Teradyne	U.S.	10.4%
Bay Networks	U.S.	10.4%
Amdahl	U.S.	9.9%
3Com	U.S.	9.8%
Intel	U.S.	9.6%

Packaged software publishers, those that produce software that is sold in a standard form to all customers and is not specifically written or adapted to a particular user's requirements, cluster at the top of the previous list.

Developing countries and local software suppliers cannot match these expenditures and must maximize their position given these constraints. Among the options available to developing countries to stimulate research and development are government incentives for local software developers, emulation of U.S. venture capital strategies, and acquisition of small U.S. software companies.

160. *See id.* at 19.

The U.S. Small Business Innovation Research Program is a useful reference point for policy makers in developing countries seeking to stimulate software development. The program was created in 1982 to strengthen the role of small firms in federally funded research and development. Since that time, the program has directed nearly 29,000 awards worth almost $4 billion in research and development support to thousands of qualified small high-tech companies on a competitive basis. Projects in computer information, processing, and analysis receive the largest share of the awards, accounting for twenty-one percent of the resources.

To obtain funding, a company applies for a phase I grant. The proposed project must meet an agency's research needs and have commercial potential. If approved, grants of up to $100,000 are made to allow the scientific and technical merit and feasibility of an idea to be evaluated. If the concept shows potential, the company can receive a phase II grant of up to $750,000 to develop the idea further. In phase III, the innovation must be brought to market with private sector investment and support.[161]

Developing countries can propel technological progress by successfully emulating U.S. venture capital approaches. Venture capital has been instrumental for the financial survival of major companies, particularly in their early stages of development.[162] The overseas software suppliers can be attractive to venture capitalists because of their small size.[163] However, the absence or limited presence of the human capital indispensable for the success of venture capital projects offsets this advantage. Particularly concerning the following prominent actors in these ventures: (1) a class of investors who understand the rules, risks, and rewards of venture capitalism; (2) financial intermediaries who are at ease in the world of technology as well as in the domains of money and management; and (3) a class of technologists willing to accept

161. *See* NATIONAL SCIENCE BOARD, *supra* note 9, at 4-19.

162. *See* LINZMAYER, *supra* note 66, at 4. (mentioning that after selling fifty Apple I computers, Apple co-founder Steve Jobs contracted Mike Markula to secure a $250,000 credit line from Bank of America. At the time, Apple had made roughly an $8,000 profit).

163. *See* OLIVER E. WILLIAMSON, MARKETS AND HIERARCHIES: ANALYSIS AND ANTITRUST IMPLICATIONS 201 (1975) (arguing that outside venture capital may be specifically earmarked for investment in high-risk inventive activities for which investor appropriability is substantial. Large firms, as usually constituted, are not calculated to attract such sources of funds).

the risk of advancing new ideas in which they have faith.[164]

In the case of India, in spite of some successful venture capital efforts,[165] the overall results have been modest. Lack of attention by policymakers and the multiplicity of regulators like the Securities and Exchange Board of India (SEBI) and the Reserve Bank of India (RBI) have been blamed for this situation. Faced with difficulties in raising funds, venture capitalist are demanding that pension funds, insurance companies, and mutual funds be allowed to invest about five percent of their corpus in venture capital funds with a proven track record, in line with the U.S. and other developed countries. Ravindra Gupta, Secretary of the Department of Electronics doubts whether it will work at all. "There is no cooperation. The environment for venture capitalism is missing. We inflate our projects, do not pay back. This has made the Indian banking system very reluctant and wary of investing."[166]

The acquisition of existing software companies can provide fast transfers of technology to the acquiring firm while facilitating easier market access for its own technologies. The following table contains the countries that have been involved in these efforts:[167]

164. *See* SCHERER, *supra* note 107, at 122.

165. *See* Sudha Nagaraj, *Floating Ventures, Hunting Money*, COMPUTERS TODAY, Feb. 15, 1998, at 49 (stating that in December 1997, the private equity fund Indocean Chase Capital Advisors placed its first start-up bet on Suresh Rajpal, former CEO of Hewlett-Packard India Ltd. Rajpal now heads E-Commerce Solutions, a Bermuda based start-up capitalized at $8 million. Techspan, a new U.S. based software consultancy firm led by HCL founder Arjun Malhotra, is being backed with an investment of $12 million by Goldman Sachs and Walden International Investment Group, an international venture capital fund. WIIG, which operates through Walden Nikko India Management Co. Ltd., has a $23 million fund focused on investment opportunities in India. Global investment major Jardine Fleming holds a twenty-five percent stake in Fujistu's Indian venture, International Computers India Ltd.).

166. *Id*. at 52.

167. *See* NATIONAL SCIENCE BOARD, *supra* note 9, at 296.

Table 7

Ownership of Software Establishments Operating in the U.S.

Total	**7,916**
United States	7,575
United Kingdom	119
Japan	30
Germany	19
France	34
Switzerland	13
Canada	52
Sweden	6
The Netherlands	18
Singapore	4
South Korea	1

Singapore and South Korea own relatively few of the software establishments. Still, their focus is well defined. These countries are building an information industry by complementing their software companies with the acquisition of U.S. computer hardware companies.[168] In addition, they are concentrating their patenting activities in computer storage, computer display, information storage devices, and other computer peripheral equipment.[169] Taiwan, and to a lesser extent, China, are attempting to implement similar strategies. Alternatively, companies such as Calcutta-based Globsyn Group have decided to set up wholly owned subsidiaries in industrialized countries such as the U.S. and U.K.[170]

This article has highlighted some of the challenges that local software producers face to pressure local authorities to improve public enforcement of intellectual property rights. These actors would benefit from the alignment of international efforts to improve intellectual property protection with their needs. Local suppliers need all the help they can get. However, in many countries they are at an early stage of development and their fate is dependent on the political will of local authorities. If local suppliers can get their governments to

168. *See id.* at 6-29.
169. *See id.* at 6-22.
170. *See* COMPUTERS TODAY, May 19, 1998, at 20.

place their needs on the political agenda and give a high priority to the development of a national software industry, then they would have contributed more to improve overseas enforcement of copyright, trademark, and trade secret rights of software companies than the current international strategies.