INTELLECTUAL PROPERTY AND THE CULTURAL ASPECTS OF COLLABORATION: COMPARISONS BETWEEN MEXICO AND THE UNITED STATES

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INTRODUCTION

Institutions of higher education, particularly in the developing world, increasingly look to other countries to develop, through research collaboration, new technologies that contribute to knowledge and institutional development as well as increase revenues. Furthermore, the pressures and benefits of a global economy have motivated the expansion of international research alliances. However, these alliances are frequently constructed between unequal partners in terms of both intellectual and material resources. This disequilibrium ultimately reinforces the social construction of marginality because dependency on scientific and technological resources is cultivated through these relationships (Alcantara, 2001a).

This chapter explores issues concerning intellectual property as well as the international and institutional aspects of university collaboration on research and technology transfers between Mexico and the United States (U.S.). To do so, we first examine international issues concerning intellectual property policy for universities in the developing world. Second, we explore challenges and dilemmas that universities in the United States currently face in their academic culture regarding intellectual property management and commercialization. Issues such as academic freedom, scientific communication, community service, financial reform, freedom of inquiry,

and policy are all implicated in this rapidly changing academic culture. Third, we describe a series of regulatory changes implemented at the National Autonomous University of Mexico (UNAM) to protect intellectual property rights (industrial property and copyright). Finally, we broadly describe programs for technology transfer between Mexico and U. S. institutions of higher education. Some of the implications of the collaborative initiatives are discussed as well.

INTERNATIONAL ISSUES OF INTELLECTUAL PROPERTY POLICY IN THE DEVELOPING WORLD

The notion of intellectual property as private property varies around the globe. In the nineteenth century, very heated debates ensued in Europe over the patent system developed in Italy and in England between the fifteenth and seventeenth centuries (Machlup & Penrose, 1950). Despite efforts to unite procedures involving international patent protection through international organizations such as the North American Free Trade Agreement (NAFTA) and the European Union (EU), in practice individual countries remain divided over policies involving the protection of intellectual property. Furthermore, especially for historically communist, socialist and developing nations, intellectual property has a strong element of community investment in which the society perceives a right to share in the resulting profits (Isla, 2000; Noetinger & Veirano, 2000; Masuda, 2000; Poltorak, 2000; Von, 2000). Since the fall of the former Soviet Union, however, most countries have been aligning their intellectual property laws and policies with those espoused by a market economy and the industrialized world (Altbach, 1996; Nesvetailov, 1995; Qiping & White, 1994; Sell, 1995). Specifically, the United States has applied significant pressure on other countries to strengthen and protect intellectual property rights through multinational corporations and international forums such as the United Nations Conference on

Trade and Development (UNCTAD), the World Trade Organization (WTO), the Trade and Tariff Acts of 1984 and 1988, and the NAFTA (Gereffi, 1978; Machlup & Penrose, 1973; Sell, 1995). While political pressure has helped curb pirating and intellectual property theft and infringement, the research literature suggests that through actual involvement and profit from research activities, other countries are beginning to perceive and enforce the spirit of the laws protecting intellectual property (Altbach, 1996; Gil, 1996; Haas, 1996; Sell, 1995; Task Force, 2000). As an historically vulnerable trading partner, Mexico has been especially susceptible to pressures to realign intellectual property laws more closely to those of the United states (Gereffi, 1978; Sell, 1995)

Recently, a team sponsored by the World Bank and the United Nations Educational, Scientific and Cultural Organization (UNESCO) argued for reforms in intellectual property rights protection for higher education. The special team contends that in an increasingly global world it is important to protect investments made in the production of knowledge. However, most patents protect a variety of advances and inventions made in industrial nations—not in developing nations. As an illustration, immigrant scientists represent a growing and significant share of the U.S. science and engineering workforce. The impact of these immigrant scientists is expressed most intensely at the highest levels of education. While foreign-born scientists represent only 9.7% of all U.S. scientists and engineers with a bachelor's degree, they represent 19.2% of all U.S. scientists and engineers with masters' degrees and 26.1% of all U.S. scientists and engineers with doctoral degrees (National Science Board, 2000). Some estimates have been made of the relative importance of international students on the U.S. economy in terms of their contribution to the services sector. The National Association of Foreign Student Advisors (NAFSA), for example, estimates that

foreign students directly spent $12.3 billion in the U.S. economy during academic year 1999/2000. This direct spending figure, however, grossly underestimates the overall impact of these international students on the U.S. economy. Likewise, there is no economic indicator that adequately captures the significance of the presence of these foreign thinkers to the U.S. economy or their absence from the economy of their nation of origin. In general, only simplistic measures exist that preclude more profound thinking and reporting on the overall impact of global science and engineering exchanges on international measures of gross domestic product (GDP).

A commonly used comparison in international trade is represented by contrasting receipts with payments of royalties and license fees generated from industrial processes. No such data exists that would show the economic impact of the higher education sector on international trade. A recent study by Lawrence Davidson (2003) includes higher education in what he defines as a "quiet export sector" that only begins to estimate the importance of higher education in the international measurement of services. To give a brief idea of the trade balance between the NAFTA nations, Table 1, below, shows the difference between Canada and Mexico in both receipts and payments of royalties and license fees to the United States generated from industrial processes:

Table 1: U.S. receipts and payments of royalties and license fees generated from the exchange and use of industrial processes in millions of U.S. dollars

Year	***Canada***	***Mexico***	***Canada***	***Mexico***
	U.S. Receipts in Millions of $		***U.S. Payments in Millions of $***	
1987	87	14	9	3
1988	60	13	11	*
1989	62	18	8	*
1990	79	23	16	*
1991	62	31	11	*
1992	47	29	10	1
1993	41	28	8	*
1994	54	33	11	1

1995	55	24	13	D
1996	81	26	57	*
1997	82	25	76	D

Source: National Science Board, 2000

This table illustrates that while U.S. receipts from Canada have actually declined over the last ten years, Mexican dependency on technology has evidently grown. By contrast, U.S. payments to Canada have increased while payments to Mexico are either negligible (*) or concealed due to corporate privacy (D) rights.

Universities and research institutions are particularly relevant to the global system of innovation due to 1) the direct training they provide to scientists and engineers, 2) their significant contribution to basic science, and 3) their direct production of new technologies and products. Just as Table 1, above illustrates Mexico's growing dependency on technologies produced in the U.S., countries throughout the developing world face significant and similar financial hurdles to research as those experienced by Mexico. At the higher education level, these impediments include limited capacity for investment in research and development activities, low numbers of scientists and engineers trained at the highest levels, low demand by industry for the research expertise at universities in the developing world as well as more pressing social demands like health care, energy, food, education and pollution control (Alcantara, 2001b). Given this example, it is foreseeable that entire regions may find themselves excluded from participation in the global system of innovation (Task Force, 2000).

The Task Force warns that although this problem is not yet serious, there is growing recognition that such barriers to participation in innovation will be aggravated as the commercialization of university based international intellectual property becomes more formalized. Among other measures, the Task Force suggests that a sliding scale for licensing agreements that takes into account a country's level

of development be utilized more widely. Another possibility should be to promote North-South joint ventures in which industrial and developing country participants earn and share intellectual property rights. A few years ago, the United Kingdom's National Endowment for Science, Technology and the Arts (NESTA) explicitly committed itself to exploring creative partnerships with innovators in developing nations. Basically, in exchange for bearing some of the risk and providing financial support, NESTA would receive a percentage of the intellectual property rights derived from those creative partnerships. In this manner, profits are fed back into the funding loop. The Task Force recommends that where models do not exist, developing nations should be prepared to innovate. There is a belief that as the knowledge economy demands new and quite different institutions, emergent economies may be better poised to respond to those demands than mature economies (Task Force, 2000).

The Organization for Economic Cooperation and Development (OECD) underscores the fact that access to the protection mechanisms of intellectual property, for the "country of origin" as well as the country to which technology is transferred, constitutes a fundamental pre-requisite to stimulate cooperative activities. These activities ultimately lead to specific agreements on technology transfer and foreign investment in countries that are technology importers. Strict laws for intellectual property protection as well as provisions for appropriate enforcement are critical elements in this direction (OECD, 1997). However, these very laws are frequently in conflict with strong cultural traditions of communal ownership as well as an academic ethos of "the intellectual commons."

INTELLECTUAL PROPERTY AND THE UNIVERSITY

Implications for Academic Culture.

As institutions and nations confront the challenges of higher education financial stringency, decentralization and reform, they likewise wrestle with the challenges of financing higher education. Thus, issues involving property rights have become progressively more pertinent for research and industrial outcomes of the education venture. Higher education institutions as well as individual countries struggle with the notion of private gain for publicly funded research. However, as the costs of operating the university become decentralized, universities must look to their outputs in order to raise revenue. In 1999, U.S. universities filed for 7,612 U.S. patents, were granted 3,079 patents, executed 3,295 licenses or options with commercial companies and collected more than $641,000,000 in royalties on inventions (Association of University Technology Managers [AUTM], 2000). Obviously, confidentiality is paramount to the production and protection of proprietary interests. But because university collaboration aspires to the ideal of a free and open exchange of scholarly ideas, this recent change to proprietary rights has had a resounding impact across the university, and indeed, around the globe. Different opinions exist, however, regarding the risks and advantages of intellectual property commercialization for higher education.

Advocates for the commercialization of university developed intellectual property argue that the knowledge production process (social or individual) is not harmed by providing legal protection to the property rights of intellectual products – particularly to those subject to patents. Furthermore, the knowledge production process is ultimately strengthened due to the reduction of conflicts caused by unfair competition. Property rights aim at granting to intellectual producers a privilege – regulated and within specific limits—over the knowledge they create. This line of argumentation also stresses that most of the typical academic "products" such as

scientific and technological research, teaching and the diffusion of knowledge through all sorts of publications—are not usually candidates for commercialization (Villarreal, 1994). Advocates also argue that legal protection for intellectual property is an indispensable aspect of stimulating and promoting scientific and technological activities. Thus, national and international patenting patterns are a valuable indicator in assessing science and technology system's productivity (Consejo Nacional de Ciencia y Tecnologia [CONACyT], 2001).

Critics of intellectual property commercialization point out that proprietary rights accrue more quickly for the already advantaged. In the United States, university commercialization has resulted in the construction of marginality for universities that don't emphasize research over teaching. Likewise, the gap between developing countries and industrialized nations continues to widen as a result of more strict protection programs (Aboites, 1993). For example, between 1990 and the year 2000, more than 700,000 patents were granted to persons, institutions, firms or residents in the U. S. Mexico was only granted 522, while Brazil obtained 711, Spain 1,937 and Korea 17,570. In the same time period, more than 50,000 patents were granted in Mexico, of which only 3,200 were granted to Mexicans (less than 6 per cent of the total) (CONACyT, 2001). Indeed, with the exception of the United States, Japan and Russia, nonresident or foreign inventors represent the majority of patents granted in most other countries. For NAFTA countries, the comparison with the United States is stark: in the year 2000, Canada issued more than 90% of all patents to nonresidents, Mexico granted a sizeable 98% of its patents to nonresidents while the U.S. issued 45% to nonresidents during the same time period (National Science Board, 2004). Tables 2 and 3 illustrate the enormous disparities in patent production between the three NAFTA economies (Canada, Mexico and the United States):

Table 2: U.S. patents granted by inventor residence:

	1985	***1990***	***1994***	***2000***
U.S. Origin	39,556	47,390	56,066	85,070
Canadian Origin	1,342	1,859	2,008	3,419
Mexican Origin	32	32	44	76
Other Foreign Origin	30,731	41,083	43,558	68,930
Total	71,661	90,364	101,676	157,495

Source: National Science Board, 2000 and 2004

Table 3: Patents granted in NAFTA countries to non-residents and of U.S. origin::

	1985		***1990***		***1994***		***2000***	
Granting Country	Patents to Non-Residents as % of total	Patents to U.S. as % of total	Patents to Non-Residents as % of total	Patents to U.S. as % of total	Patents to Non-Residents as % of total	Patents to U.S. as % of total	Patents to Non-Residents as % of total	Patents to U.S. as % of total
Canada	92.8	54.8	92.2	52.2	92.7	51.3	90.8	56.9
Mexico	93.4	56.3	92.0	63.4	93.4	58.0	98.0	58.7
U.S.	44.8	55.2	47.6	52.4	44.9	55.1	46.0	54.0

Source: National Science Board, 2000 and 2004

Aboites (1993) argues that one implication for the least developed of the three NAFTA partners is that protection of intellectual property may lead the Mexican economy to warrant that knowledge that has been accumulated for multinational corporations would be protected by the Mexican government. Another implication is that, as most research and development (R&D) in Mexico is conducted at public universities and research institutes, their agendas and research priorities would be set up in accordance to commercial rather than academic interests.

Commercialization and Community Service.

Given the potential of intellectual property commercialization to imperil the liberal university's future, Claire Polster (2000) points out the importance of exploring how it works and how it may be resisted. She argues that dynamics set into motion by the commercialization of intellectual property are eroding the university's ability to draw on and to replenish the intellectual commons—a fundamental precondition to the survival of the university. Because commercialization of intellectual property changes the reward structure for faculty within the university,

these ventures also prevent academics from fulfilling their public service mission. As the academy decreases its service to the public, the very popular support that is essential to its survival will be challenged. In her view, these two mutually reinforcing developments are making it increasingly difficult for the liberal university to continue on as it has. Intellectual property management ultimately produces a qualitative transformation of the institution that is economically and socially costly to society. Polster argues that although current developments pose very serious threats to the liberal university's future, there is still time to intervene in order to preempt or to alter them. She advocates for a strategy of pursuing broad intellectual property exemptions for universities.

Academic Freedom.

In a similar vein, M. M. Scott (1998) compares the potential harm of intellectual property rights in academia to a ticking time bomb. Scott points out that for a long period of time, ideas have been owned by the person who produced them. Recently, however, universities have begun to act like corporations, attempting to claim ownership of professors' ideas in order to market them. This change may have two devastating consequences for academics. In the short run, the new market-based strategies abridge academic freedom; in the long run, they have the potential to diminish the human knowledge base.

Scott argues that not only scientists and those who deal with patents must now concern themselves with intellectual property rights: she has observed many administrators and trustees examining the arts and humanities for ideas and products they can sell. Scott underscores, however, that it may be possible to defuse the bomb before it explodes. By describing the experiences of Indiana University's Intellectual Task Force, Scott illustrates the academic community's response to the problem at

this university. Scott details the ensuing debates about intellectual property, the policies governing it, and their implications for the long-term health of the university. The Indiana University Task Force developed a set of four principles governing intellectual property:

1. The university is first and foremost an academic institution whose fundamental missions are research, teaching and service in furtherance of its principal aim of the advancement of knowledge and toward the ultimate aim of the greater public good.
2. Academic freedom is one of the most basic principles governing academic institutions and in maintaining the university's role in society as an independent critic.
3. The free and open exchange of ideas and information is fundamental to the very reason for being a university.
4. There shall be no requirement that any intellectual property be exploited commercially; the university cannot transfer intellectual property to a third party without the permission of the creator/faculty member.

In accordance with these principles, Scott concludes that it is important for universities to recognize their mandate to conduct free and open research and maintain an environment of unrestricted exchange of ideas for the greater common good (Scott, 1998).

Unfortunately, the ability for any university to foster an unrestricted exchange of ideas for the greater common good is increasingly tied to university commercialization efforts. In 2001, for example, of the 3,600 institutions of higher education in the United States in 1999, 200 universities accounted for 96% of all

research and development expenditures. Furthermore, the top ten institutions received 20% of all academic research and development funds; the top twenty institutions spent 34% of all research and development funds and the top 50 institutions spent 57% of all R&D funds (National Science Board, 2004). This growing concentration of funds in top tier universities tends to reinforce the structure of marginalization between university types. While some institutions like Indiana University at least pay lip service to the importance of academic freedom, other more competitive universities are establishing structures such as business incubators and spin-off companies to improve the status of their institution. It should be noted that Indiana University has subsequently strengthened its technology transfer initiatives and is taking more aggressive measures toward commercializing and "harvesting" intellectual property.

Policy Implications.

Several aspects of the implications of intellectual property for universities have been documented through empirical research. Slaughter and Rhoades (1993) observed the way the state has helped shape the climate for the commercialization of science in a public university, and how this—in turn—has shaped the terms of professional labor for faculty. They examined patent policies of a public research university and of its Board of Regents, and the relevant state statutes from 1969-1989. Slaughter and Rhoades stressed that policies and statutes moved from an ideology that defined the public interest as best served by shielding public entities from involvement in the market, to one that saw the public interest best served by public organizations' involvement in commercial activities. In their view, claims to the ownership and rewards of intellectual property shifted dramatically in that time, from faculty owning their products and time to complete ownership by the institution. The

contract between the university and faculty became increasingly formalized and specified. Slaughter and Rhoades also believed that such development augured significant changes in professional labor and in the relationship between the state and higher education (Slaughter & Rhoades, 1993).

In their 1999 study Daza Campbell, Teresa Isabelle and Sheila Slaughter (1999) explored areas of possible tension between faculty and administrators engaged in university-industry activity by investigating the key sources from which tensions are more likely to emerge: issues related to conflicts of interest (conflict over financial issues, e. g., revenue-generating opportunities through patents and licensing); conflict of commitment (conflict over competing faculty responsibilities, e.g., whether faculty allocate more time to their traditional academic duties or to their industrial sponsor); and conflict over internal equity (conflict over the university's internal distribution of rewards and workload).

Their study compared two groups of academics and administrators (those involved in university-industry collaborative activity and those who were not). A fundamental premise of their research was that a significant number of American universities are seeking resources from industry, and at the same time firms are seeking knowledge, know-how, and people from universities. Analysis of the several groups' responses to the survey pointed to two sets of tensions that stem from increased university-industry activity primarily centering on autonomy, resources, and flexibility to capture financial gain. The first was between involved faculty and involved administrators, the second between involved faculty and non-involved faculty. The authors conclude that the manner in which these tensions are resolved will have important implications for the organization of faculty work, students' experience with the educational system, and administrators' efforts to respond to

pressures from federal and state regulators. Furthermore, the numerous ambiguities suggest that these issues are unresolved and perhaps volatile (Campbell , Isabelle & Slaughter, 1999).

Although this section of the chapter examined a number of implications of establishing organized intellectual property management in several U. S. universities, we believe that higher education institutions in the developing world will also face, sooner or later, some of the challenges and dilemmas reviewed here. Especially as private and technological institutes continue to increase throughout Mexico and as Mexico's National Autonomous University (UNAM) continues to produce a significantly higher number of graduates in science and engineering programs.

INTELLECTUAL PROPERTY AND TECHNOLOGY TRANSFER IN MEXICO

A number of legal regulations concerning intellectual property have been established since the 1990s at Mexico´s National University. Issues such as editorial works, discoveries, inventions and artistic works expressed in a variety of forms constitute a great deal of UNAM's most valuable assets. Currently, however, Mexican law stipulates that the university—not the faculty or the government—owns academic intellectual property. This is contrasted by Canada, where both the university and the faculty have legal ownerships rights to innovations created at the university and the U.S. where the university, faculty and the government may share property rights to university innovations (National Science Board, 2004).

Due to its huge size and long tradition in several fields of scientific and social research as well as strong programs in the arts and humanities, issues of intellectual property ownership and protection have become increasingly important at UNAM. Although several governmental offices and departments in charge of dealing with the legal aspects of copyright and industrial property already exist in Mexico, UNAM has

just opened a University Registration Office for Intellectual Property. This office has been attached to UNAM's Attorney General's Office. This office has been established to coordinate all the guidelines and regulations concerning intellectual property at UNAM and to serve as a liason with other government offices and departments dealing with intellectual property issues. (UNAM, 1994, Gaceta UNAM, 2002).

Furthermore, a study by Rogers, Yin and Hoffman (2000) indicates that there is a correlation between the maturity of such offices and the increased awareness of the problems and possibilities of commercialization for the university. Age of such programs in the United States vary from 77 years (University of Wisconsin) to one year old. Most U.S. technology transfer offices, however, emerged within the last five to 20 years. Comparatively, then, UNAM's technology transfer office is just now beginning this process of commercialization and capitalization.

TECHNOLOGY TRANSFER COLLABORATION BETWEEN MEXICO AND THE U.S.

A comprehensive inventory of technology transfer agreements, patent production activity and licensing agreements between U.S. universities and institutions in Mexico is not yet available—most likely because very few exist. We contacted 10% of the 139 respondents to the Association of University Technology Manager's annual survey to ascertain the landscape of such joint commercial ventures. The technology managers acknowledged that tracking such information would be very difficult to do because the purpose of the Bayh-Dole Act was to increase university partnerships with U.S. industry. For instance, if a U.S. university participates in research with industry, it is quite possible that the industry could license that patent in another country without the knowledge of the university. Instead, the technology managers surveyed indicated that co-authorship on journal

articles might be the best indicator of cooperative research efforts that could result in intellectual property.

Both patents and published articles are considered by the National Science Board to be two primary outputs of scientific and engineering research. Because the promotion and rewards structure for most university faculty measures peer reviewed publication of research articles, data on authorship of peer-reviewed publications is perhaps the most reliable measure of academic productivity and collaboration. As discussed above, wealthy nations are dominant in the ownership of patents compared to less developed countries, high-income OECD countries are also responsible for more than 80% of all publications in the world's key science and engineering journals (National Science Board, 2004). The National Science Board asserts that despite the fact that "world article output increased by almost 40 percent from 1988 to 2001….low-income nations experienced little change in their shares of the world's Science and Engineering publications" (2004, p. 5-39). However, international collaboration on articles doubled from 8 to 18 percent between 1988 and 2001 (National Science Board, 2004). Alarmingly, since NAFTA was signed, the portion of co-authored science and engineering articles between the U.S. and both Mexico and Canada has dropped between 1994 and 2001 at the same time that U.S. patenting activity in both countries has increased.

Consequently, in order to glean some insight into the nature and extent of collaborative efforts between universities and higher education institutions—in addition to the implications that intellectual property has for academic life—it is helpful to examine less formal collaborative efforts between U.S. and Mexican universities and higher education institutions. Likewise, collaborative efforts between higher education institutions and government agencies in both countries help to

illustrate the current cooperative posture and may lead to more significant collaboration at a later point.[1] What follows is only a sample of those mutual efforts:

An agreement between Universidad Autonoma de Nuevo Leon (UANL) and the University of Arizona concerning technology transfer, is currently in progress. At a more governmental level, the Association Liaison Office for University Cooperation in Development (ALO), established in 1992, coordinates the efforts of the country's six major higher education associations[2] to build their partnership with the U. S: Agency for International Development (USAID), and to help their member institutions plan and implement development programs with colleges and universities abroad. It is within this framework that six U. S. institutions entered in partnership with the same number of Mexican institutions. The aim is to develop collaborative programs seeking cooperation with business and industries through teaching, research and service activities (ALO web page, 2001).

Recently, the U. S. Government announced the launching of the U. S. Mexico Training Internships, Education and Scholarship Partnership (TIES/Enlaces). The goals of this program are to facilitate pursuit of the common agenda for development that is emerging in the U. S. – Mexico bilateral relationship. TIES/Enlaces will be focused principally on education and human capital development, natural resources management and environmental science, information technology for development, health, agriculture, humanitarian assistance, transparency and decentralization, micro and small business development, international finance, public policy and administration. The program is a six-year, $ 50 million public-private alliance designed to stimulate social and economic growth in Mexico by supporting institutional strengthening in higher education through education programs, scholarships and university linkages. TIES/Enlaces will provide about 750

scholarships for Mexicans to study in the United States. Most of the scholarships will be awarded to Master's degrees or special graduate programs in American colleges and universities; other scholarships will fund enrollment of Mexicans in undergraduate courses. A number of Master's degree candidates will participate in internships in governmental agencies, NGOs or the private sector as an integral component of their academic study program (U. S. Embassy in Mexico, 2001).

Border PACT is another initiative whose motto is: "Border higher education institutions fostering change in the U. S. – Mexico borderlands". The conveners in this collaborative effort are Consortium for North American Higher Education Collaboration (CONAHEC), American Council of Education (ACE), and Mexico's ANUIES (National Association of Universities and Institutions of Higher Education). Border PACT members underscore that despite the important structural differences between the Mexican and U. S. higher education systems, there are many similarities in the challenges and areas of opportunity that each country faces. There are four principal issues that constitute the agenda of borderlands higher education institutions:

- Expanding access to higher education and serving "new" clients
- Maintaining and improving quality
- Increasing higher education institutions' involvement in their host communities and elevating their role in economic development, and
- Improving accountability and effectiveness.

Although some of these challenges are much more critical in Mexico, they continue to be of significance for higher education policy in the U. S. (Border PACT Network home page, 2001)

The United States-Mexico Foundation for Science has as its mission “to promote and support bilateral collaboration in science and technology using contacts and strategic alliances within the scientific, political and academic communities to strengthen bilateral collaboration”. The Foundation’s goal is to address “the problems in areas such as health, poverty, agriculture, education and the environment” (FUMEC web page). In December, 1999, a $ 13.9 million endowment was established, allowing the foundation the establishment of bilateral programs that respond to issues of mutual concern to the U. S. and Mexico. The U. S. - Mexico Foundation for Science has established as its main priority issues related to sustainable development. Some of these issues are part of the environmental degradation that are so prevalent in large cities and fast growing regions like the U. S. Mexico borderlands (The U. S. – Mexico Foundation for Science web page, 2001). The following problems are included in the Foundation's agenda:

- Water (water and health along the U. S. – Mexico border; technological innovation support for water utilities; and clean water in small communities)
- Sustainable Industrial Development (science, technology and industrial sustainable development along the U. S. Mexico border)
- Sustainable Urban and Rural Development (Sustainable urban development along the U. S. – Mexico border; air quality in large cities [the Foundation supports the study of atmospheric pollution in Mexico City by a bilateral group, led in the U. S. by the MIT and in Mexico by a consortium of eight research groups]; and exploratory activities in agriculture and rural sustainable development)
- Enhancement of Human Resources in Science and Technology (Visiting senior scientist program; summer fellowship program for young scientists;

training of specialists in science and technology policy and strategy; and workshops on advanced research techniques).

- Bilateral Research Projects (each project strengthens bilateral collaboration by fostering productive relationships between U. S. and Mexican researchers).

Finally, during the last decade Mexico's National Council for Science and Technology (CONACYT, its Spanish acronym) and the National Science Foundation (NSF) signed a memorandum of understanding in order to facilitate the exchange of experience in different areas of science and technology. The development of a joint financial program was also included. However, no further information on these issues is available thus far.[3]

However, these productive partnerships must be tempered by a recent example of the external commercialization of the Mexican University. Sylvan Learning Systems, a "for profit" educator, recently purchased a controlling interest in Mexican private universities and hotel management schools. This "transaction" combined with the current emphasis and prioritization of distance learning initiatives in Mexico indicate that the commercialization of the university in Mexico has already begun.

The experiences of university collaboration between American and Mexican institutions of higher education that were widely reviewed in this chapter show an increasing significance in the bilateral agenda. Primarily, most of the programs discussed above promise the beginning of concerted cooperation aimed at tackling issues of mutual concern--particularly those related to issues of sustainable development such as water; urban, rural and industrial sustainable development, etc. In addition to evaluating the results of the specific projects, it remains to be seen whether the academic approaches to the issues under inquiry –expressed in policy recommendations—would not conflict with the interests of corporations. Some of

these contradictions would appear, for example, on issues such as disposal of water residual and other forms of industrial pollution along the U. S. – Mexico borderland.

CONCLUSION

This chapter has reviewed some of the complex issues surrounding university involvement in the production of intellectual property. Recent changes that foster and encourage commercialization in the university have significant implications for university academic life and centrally held values such as academic freedom, scientific communication, community service and freedom of inquiry. While these dilemmas are experienced most strongly at the leading research universities in the developed countries, they create implications for universities and other higher education institutions in the developing world. While joint research collaborations between U.S. universities and institutions in Mexico provide social promise, adequate protections in strictly commercial ventures must be established to prevent economic exploitation and cultural domination.

Currently, there are a number of genuine efforts between U.S. universities and Mexican institutions of higher education to study and resolve common problems. These programs provide promise for tackling critical issues for both countries through mutual efforts. However, the overarching needs of each country and the spirit of authentic reciprocity in the development of common projects should extend to the commercial sphere as well.

[1] We are grateful to Francisco Marmolejo, executive director of the Consortium for North American Higher Education (CONAHEC) for providing us with very useful advise about this topic.
[2] The American Association of Community Colleges (AACC), the American Association of State Colleges and Universities (AASCU), the American Council of Education (ACE), the Association of American Universities (AAU), the National Association of Independent Colleges and Universities (NAICU), and the National Association of State Universities and Land Grant Colleges (NASULGC).
[3] This information was provided by Francisco Marmolejo in personal communication with the authors of this paper.

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