The Institute of Brazilian Business and Management Issues - IBI

PROPOSAL FOR ANEEL'S POLICY OF STRENGTHENING PROTECTION FOR INTELLECTUAL PROPERTY RIGHTS

By Eliane Bezerra de Carvalho

Minerva Program, Fall 2000

Advisor: Robert M. Sherwood

Contents

1. Introduction

A revolution is sweeping through the electric power industry. Vertically integrated monopoly suppliers and tight regulation are being replaced with a diversified industry structure and competition in the generation and supply of electricity.

The reform of the Brazilian power industry started in 1995. On July 7 of that year the Concessions Act, Law no. 9,074, was enacted, defining new rules to award concessions of public services, and introducing the first steps towards competition. The Brazilian power industry restructuring has been pushed by privatization. By the end of 1996, Law no.9,427 created the Brazilian Electricity Regulatory Agency – ANEEL, which was effectively implemented one year later.

Although regulation can prevent economic harm and protect economic benefits, real productivity gains over time depend on innovation – on the steady flow of new ideas, products and processes. Moreover, innovation relies strongly on Intellectual Protection Rights (IPRs) protection.

Several broad classes of technology hold the potential to dramatically reshape the future of the power system: 1) solid-state power electronics that make it possible to isolate and control the flow of power on individual lines, in subsystems, within the power transmission system, and in end-use devices; 2) advanced sensor, communication, and computation technologies, which in combination can allow much greater flexibility, control, metering, and use efficiency in individual loads and in the system; 3) superconducting technology, which could make possible very-high-capacity underground power transmission, large higher-efficiency generators and motors, and very short-term energy storage; 4) fuel cell technology for converting natural gas or hydrogen into electricity; 5) efficient, high-capacity, long-term storage technologies (including both mechanical and electrochemical systems such as fuel cells that can be run backward to convert electricity into easily storable gas) which allow the system to hold energy for periods of many hours; 6) low-cost photovoltaic and other renewable energy technology; and

7) advanced environmental technologies such as low-cost pre- and post-combustion carbon removal for fossil fuels, improved control of other combustion byproducts, and improved methods for life-cycle design and material reuse (MORGAN & TIERNEY, 1998).

These are only a few of the possibilities that new technology may hold for the future of the power industry. How that future will be depends critically on policy choices made today to foster the rate at which different technologies emerge. In this regard, the aim of this study is to propose an appropriate regulatory framework to address the IPRs protection in the Brazilian Power Sector's Technological R&D Program.

The next chapter of the study presents the basic concepts concerning IPRs. The Brazilian legal framework related to IPRs protection is dealt with in chapter 3, where the main changes introduced by Law no. 9,279 are also addressed. Chapter 4 describes the Brazilian Industrial Property Institute's structure and roles. The aggressive role played by the American government to promote innovation is discussed in chapter 5, together with a variety of federal legislative programs and activities implemented since early 1980; there, the strategies adopted by American universities to pursue IPRs protection of their invention under the new legislature are also evaluated. Chapter 6 shows the problem of reduced spontaneous R&D investments of the utilities in the power sector as a result of competitive pressures and describes how regulatory agencies, in US. and Brazil, have adopted recently mechanisms to provide adequate funding to R&D in that sector. Chapter 7 puts forward a proposal of a regulatory framework in the field of intellectual property and technology transfer for the Brazilian Power Sector's Technological R&D Program. Finally, chapter 8 concludes the study.

2. Intellectual Property Rights

In simple terms, intellectual property is a product of the human intellect that has commercial value. Intellectual property encompasses a wide range of creations – from fiction, poetry, songs, designs and artwork to ads, product names, mechanical inventions, processes, chemical formulas, machines and software.

The commercial value of intellectual property comes from the ability of its owner to control its use. If the owner could not legally require payment in exchange for use, ownership of the intellectual property would have intellectual worth but no commercial value.

Intellectual property rights (IPRs) define the extent to which their owners may exclude others from activities that infringe or damage the property. Thus, IPRs set out and protect the boundaries of legal means of competition among firms seeking to exploit the value of creative assets. In principle, efforts to extend the rights beyond these boundaries are denied. In this context, it is more fruitful to conceive of IPRs as rules regulating the terms of static and dynamic competition, rather than mechanisms for creating legal monopolies. While IPRs do create market power, the impact on competition varies as widely across products, technologies, and countries as it does across the form of rights granted and the scope of protection. Indeed, the strength of the protection depends not only on the scope of the rights granted, but also on the ability of competitors to create non-infringement products and technologies and the ability of consumers to substitute among supply sources.

Traditionally, developing countries have established IPRs systems favoring information diffusion through low-cost imitation of foreign products and technologies, believing that domestic innovation was insufficient to warrant protection. However, inadequate IPRs can stifle technical change even at levels of economic development because much invention is aimed at local markets and can benefit from local patent or utility model protection. Through in the overwhelming majority of cases invention is simply minor adaptation of existing technologies, the cumulative effect can be critical for growth in knowledge and activity (MASKUS, 2000).

2.1 Intellectual Property Law

Intellectual property law is an umbrella term for all the statutes, government regulations and court decisions that together determine who owns intellectual property and what rights go along with that ownership. In addition, intellectual property law specifies:

- The conditions under which IPRs may be sold or loaned – licensed – to others for specific purposes;
- How to settle contract disputes that arise from marketing intellectual property;
- How to take advantage of government procedures and programs that establish or enhance protection of IPRs.

Intellectual property law primarily offers protection to the owner of intellectual property by giving the owner the right to file a lawsuit asking a court to enforce whatever rights are being transgressed. As a result, some experts describe intellectual property laws as "affirmative rights" rather than as "protection". In other words, intellectual property laws will not prevent someone from stepping on the owner's rights. But the laws do give an owner the ammunition to take a trespasser to court. For example, upon request of the copyright owner, a court will halt unauthorized copying of material protected by the copyright. But if the copyright owner does not sue the copier, no action will be taken and the copier will get away with this illegal behavior.

2.2 Types of Intellectual Property Laws

Intellectual property law consists of several discrete legal categories. Although these categories can overlap with respect to a particular intellectual property, they each have their own characteristics and terminology.

Trade secret law affords the owner of commercial information that provides a competitive edge the right to keep others from using such information if the information was improperly disclosed to or acquired by a competitor and the owner of the information took reasonable precautions to keep it secret.

Copyright law protects all types of original creative expression, such as that produced by authors, composers, artists, designers, programmers and Web page designers. However, copyright law does not protect the ideas and concepts underlying an expressive work; it only protects the literal form the expressive work takes.

Trademark laws protect the distinctive – unique, creative or well-known through use – names, designs, logos, slogans, symbols, colors, packaging, containers and any other devices that are used by businesses to identify the source of their goods and services, and distinguish them in the market-place. This protection can last indefinitely.

Patent law gives the inventor of a new and nonobvious invention the right to exclusive use of that invention for a limited term. How long the inventor retains the exclusive right depends on the kind of patent. A utility patent goes into effect when issued by INPI and expires 20 years after the application for the patent was filed. A design patent lasts 15 years after the date the patent issues.

2.3 Unfair Competition Laws

Courts are frequently asked to intervene when one business uses unfair tactics to compete with another business. Among the unfair tactics the courts have condemned is a business try to lure costumes away from a competing business by confusing customers as to which business or products they are dealing with. The most common way to confuse customers is for a second business to market its goods or services under a name or other mark that is confusingly similar to that used by the first business on its goods or services.

Unfair competition is not usually considered a separate branch of intellectual property law, as it targets general business practices rather than intellectual property as such. However, because the use of misleading names and marks to improperly lure customers away from another business is also very much what trademark law is concerned with, the two types of law often overlap.

2.4 International Laws

Under a variety of treaties, most countries in the world offer protection to national intellectual property used abroad. And under these same treaties, the Brazil protects intellectual property created in these other countries. Several major international treaties – the Berne Convention is the most important – govern rights in copyrights in most countries. International patent rights are broadly recognized under Paris Convention and the Patent Cooperation Treaty. Trademark owners also have some international rights under the Paris Convention. And industrial secrets receive international protection under Trade-Related Aspects of Intellectual Property Rights - TRIPS.

2.5 Patents

Patents are legal titles granting the owner the exclusive right to make commercial use of inventions. To qualify for patent protection, inventions must be new, non-obvious, and commercially applicable. The term of protection is usually limited to 20 years, after which the inventions moves into public domain. The patent system is one of the oldest and most traditional form of IPRs protection. Almost all manufacturing industries make use of the patent system to protect inventions from being copied by competing firms. Since the early 1980s, patents have also been granted for agricultural biotechnology products and processes and for certain aspects of computer software.

As an adjunct to the patent system, some countries have introduced *utility models*. The novelty criteria for utility models are less stringent and are typically granted for small, incremental innovations. Their term of protection is far shorter than for "regular" invention patents, typically four to seven years. Similarly, *industrial designs* protect the ornamental features of consumer goods such as shoes or cars. To be eligible for protection, designs must be original or new. They are generally conferred for a period of five to fifteen years.

2.6 Copyrights

Copyright protects original works of authorship. Copyright protection differs from patent protection in that copyright solely protects the *expression* of an intellectual creation, whereas the ideas or methods advanced in the title can be freely copied. Copyright protection typically lasts for the life of the author plus 50 to 70 years. It is applicable to literary, artistic, and scientific works. During the past decade, copyright protection has also developed as the main form of protection for computer software. Limits to exclusive rights exist in certain "fair use" exemptions, such as educational or library use or for purposes of criticism and scholarship.

2.7 Trademarks

Trademarks are words, signs, or symbols that identify a certain product or company. Trademarks seek to protect a product's and firm's reputation for quality. Customers are offered the assurance of purchasing what they intend to purchase. Trademarks can endure virtually indefinitely provided they remain in use. Almost all industries use trademarks to identify their goods and services. The use of trademarks has turned out to be of high significance in certain consumer goods industries, such as clothing and watches. Similar to trademarks, *geographical indications* identify a product with a certain city or region, e.g. wine or olive oil.

2.8 Trade Secrets

Trade secret is defined as information, including but not limited to, technical or non-technical data, a formula, pattern, compilation, program, device, method, technique, drawing, process, financial data, or list of actual or potential customers or suppliers, that: (1) is sufficiently secret to derive economic value, actual or potential, from not being generally know to other persons who can obtain economic value from its disclosure or use; and (2) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy or confidentiality.

There is no uniform definition of a trade secret which is accepted around the world. Even within the United States, where trade-secret law is largely a function of state regulation rather than federal law, which is the basis of the patent laws, variations exist around the United States. In some states, trade-secret law arises from common law. In these states, the law is based upon the Restatement of Torts. However, other states do not base their law of trade secrets on the Restatement, but on the Uniform Trade Secret Act (Uniform Act), which was drafted by the National Conference of Commissions on Uniform State Laws and adopted in 1979. In these states, the legislature has passed statutes defining the scope of trade-secret protection, sometimes with significant deviations from the text of the Uniform Act.

To prove a trade secret the plaintiff must establish the extent to which the information is known outside of the trade secret owner's business; the extent to which it is known by employees and others involved in the trade secret owner's business; the extent of measures taken by the trade secret owner to guard the secrecy of the information; the value of the information to the trade secret owner and his competitors; the amount of money expended by the trade secret owner in developing the information; the ease or difficulty with which the information could be properly acquired or duplicated by others.

Trade-secret protection differs from other forms of protection in that it does not grant an explicit title to the creator of an original work. Instead it protects businesses from the unauthorized disclosure or use of confidential information. Such confidential information includes inventions not yet at the patent stage, ways of organizing business, client lists, purchasing specification, and so on. Copying through reverse-engineering does not infringe trade-secret laws. In essence, all industries possessing secret business information rely on trade-secret protection to safeguard their intangible assets.

A trade secret can only be held or used lawfully by a person who acquires it lawfully Thus proprietary information should not lose its trade secret status when misappropriated through theft, espionage, bribery, coercion, trickery, or breach of a confidential relationship with the owner. Third parties who acquire trade secrets with knowledge that they are misappropriated obtain no greater rights than the person who initially misappropriated the information. If a trade secret is published independent of misappropriation or industrial espionage, it may be that the secret status of the trade secret is defeated. If a third party first learns that information is a trade secret after he comes into possession of it, he is obligated to protect its trade secret status. Thus, a company that learned, after the fact, about a misappropriated trade secret obtained by an employee was liable for disclosures of the trade secret after it received notice of the misappropriation.

Many of the key strategic decisions in the area of trade secrets concern the choice between patent protection and continuing to protect an invention as a trade secret. Sherwood (2000) conducted a survey among members of the Licensing Executives Society to find out what portion of the technology has been transferred from one place to another has depended on trade-secret protection. The private law firm members said about 40 %. However, the corporate lawyers and licensing managers – the people closest to creation and transfer of technology – said over 60%, with many of them reporting 90% or more. Perhaps that indicates the importance of trade-secret protection.

Ultimately, the decision to select either patent or trade secret protection will depend upon a variety of factors, including the anticipated life of the advantage that the invention provides over competitors, the costs and risks of maintaining trade-secret protection, the difficulty of proving patent infringement, and the anticipated efforts of third parties to replicate the invention. If the owner of the invention believes that third parties will be able to easily duplicate the invention, perhaps through reverse engineering, patent protection may be appropriate. On the other hand, if the owner believes that it would be difficult to prove infringement after full disclosure of the invention in the patent application, the owner may prefer to rely on trade-secret protection, so long as the costs of maintaining secrecy are not overwhelming.

3. The Brazilian Legal Framework

New laws and regulatory acts were issued bringing the country's protection pattern along with international ones as defined by international treaties. A new law – Law 9,279/96 – came into force on

May, 1997. One very important aspect of this law is related to the protection on sectors where patents were not granted before. A regulatory act, number 126, establishes transitional rules for these so called "pipeline patents".

The protection of industrial property was introduced in the country in the last century. Brazil was one of the eleven countries which signed the Paris Convention on 1883, the earliest and most important multilateral treaty in this field. This convention served as a normative instrument to guide the revision of a former Brazilian law of 1830 for patents of invention.

In 1887, a new patent law was enacted in Brazil, based on that international instrument, to make our domestic system compatible with the external one. The country has been, since then, present in discussions about matters concerning industrial property, with a special concern towards the importance and correlation of the patent and trademark system and the effective transfer of technology.

In 1971, a Industrial Property Code was issued in - Law 5,772/71, empowering INPI with new functions and tasks, thereby bringing the Brazilian industrial property system close to those operating in many industrialized countries. The Brazilian code established the protection of industrial property right, by means of:

- The grant of patents for inventions, utility models, industrial models and industrial designs;
- The registration of industrial, trade or service marks and publicity slogans or signs;
- The prevention of false indication of source;
- The prevention of unfair competition.

In May 1996, a new law, number 9,279, was enacted to regulate rights and obligations relating to industrial property. The new law came into force on 15 May 1997, following the approval of normative acts concerning its implementation. The new law complies fully with the provisions of the TRIPS

Agreement (Agreement on the Trade Related Aspects of Intellectual Property Rights), as well as with other agreements either in place or under discussions in the industrial property field.

3.1 Law 9,279/96

The law, which came into force on May, 1997, develops the previously referred legislation concerning industrial property rights. As a whole, it should, clearly, add to business confidence and willingness to invest. Among the significant changes introduced by the new law area.

However, the enforcement of IPRs in Brazil, as perceived by United States business interests, is considered weak. Maskus (2000) has used the annual National Trade Estimate Reports of the US Trade Representative (USTR) to track changes from 1986 to 1998 in IPRs of major nations. The description chosen – weak, moderate, good, and strong – reflect the nature, frequency, and severity of the complaints issued by USTR.

The number of patent applications has been rapidly increasing. A considerable part of this is due to growth in the Patent Cooperation Treaty (PCT), which in turn stems from increasing worldwide confidence in the international patent system, but increasing confidence in the Brazilian approach must play a part. The new law will give added impetus to this trend.

In the field of trademarks, the picture is similar. The new law should make it easier to obtain valid registration for, and rights in, a wider range of marks and therefore increase the confidence of enterprises that their distinctive signs cannot be easily copied. The simplified procedures should make the system more attractive.

The main changes introduced by Law 9,279/96 are:

- The previous patent law excluded, for example, substances, materials or products obtained by chemical processes; pharmaceuticals and foodstuffs, mixtures of metals and alloys in general; combinations of known processes; and the uses or application of discoveries. All such subject matter should now be eligible for patent protection, as should transgenic microorganisms;

- A grace period of 12 months in which an inventor may disclose his invention before the priority date;
- The term of patents of invention was extended from 15 to 20 years;
- The term of utility models was extended from 10 to 15 years;
- Internal priority, derived from an earlier application by the same applicant or his successor in title, was introduced;
- The possibility of expropriation is no longer provided without a previous compulsory license being granted;
- Industrial design protection will be only in relation to non-functional appearance, shape of configuration;
- A broader definition of what may be registered as a trade mark is introduced and the registration of certification marks is provided for;
- Publicity slogans ad signs may no longer be registered as such, whilst geographical indications may now be registered;
- Examination of trade marks will not be performed until after they have been published and the period for opposition has expired;
- The meaning and consequences of infringement of industrial property rights are embodied;
- Unfair competition practices are defined.

3.2 Law 9,609/98

In February 19th, 1998, Law 9,610 was issued in order to regulates copyright over software. It establish the author rights; the term of protection is limited to 50 years; the option to register; the rights of employers and employees; the users' guarantees; voluntary licenses; contracts of licenses and royalties; technology transfer; and criminal and administrative sanctions.

3.3. Law 9,610/98

The Law 9,610, issued in February 19th, 1998, replaced the former legislation with regard to copyright. It establishes the scope of protection; the optional registration; the term of protection; it disciplines the transfer of rights; the connected rights (interpreters, producers); the rights of association; and infringement.

Copyrights lasts for the author's life plus 70 year. A creative work is protected by Law 9,610 the moment the work assumes a tangible form. Thus, a copyright register is not necessary to obtain basic copyright protection.

When a copyright owner wishes to commercially exploit the work covered by the copyright, the owner typically transfers one or more of these rights to the publisher or other entity who will be responsible for getting the work to market. It is also common for the copyright owner to place some limitations on the exclusive rights being transferred.

4. The Brazilian Industrial Property Office – INPI

In 1970, the National Industrial Property Institute, which Portuguese abbreviation is INPI, was created, by Law 5,648, December, 11th, within a modernization process of the Brazilian industrial property system. INPI is subordinate to the Ministry of Development, Industry and International Trade, but benefits from a certain administrative and budgetary autonomy.

The office receives 65,000 trademarks applications annually. In 1995, 14,000 applications were filed for patents (national applications plus PCT entered into national phase), including utility models. It must be noted that extensive technical examination is done by consulting an international patent document collection which includes CD-ROM series.

Besides its volume of work, the national extension challenges the system to be truly national, in a sense that connections must be provided through a large web. Nearly 50% of all the patent and trademark applications and other transactions are filed at the São Paulo branch.

When created, INPI was charged with the responsibility for the implementation of legislation on industrial property, regarding its social, economic, legal and technical function and for the adoption of measures in order to accelerate and regulate the transfer of technology. INPI is also in charge of making recommendations concerning the desirability of signing, ratifying or withdrawing from conventions, treaties and other agreements on industrial property and transfer of technology.

Shortly after the office was created, an extensive training and modernization process was initiated with the assistance of UNDP and WIPO, during which a core of skilled patent examiners was formed and a Center for Documentation and Technological Information was established. So as to execute its legal attributions, INPI is composed, apart from its administrative staff, of four major Technical Bodies:

- Patents: Composed by the following six technical divisions: Organic Chemistry; Inorganic Chemistry; Mechanical Engineering; Electrical, Electronic and Physics Engineering; Civil Engineering and Industrial Models and Designs;

- Trademarks: With five sections grouped by technical fields;
- Technology Transfer: With three divisions trained to analyze contract registration;
- Information and Documentation Center: An important segment within the INPI to support the use of information contained in patent documents and its dissemination to the industrial sectors.

INPI must, as well, prepare recommendations concerning the desirability of signing, ratifying or withdrawing from conventions, treaties and other agreements on industrial property and transfer of technology. A broad range at international cooperation activities is covered. INPI participates actively in assemblies and meetings concerning treaties in matters of industrial property (Paris Convention, Patent Cooperation Treaty, Strasbourg Convention on International Patent Classification), Brazil takes also part in WIPO's Working Group (Patent Information, Harmonization, Biotechnology) and TRIPS.

In the multilateral level, INPI promotes, through the cooperation agreement with WIPO, an annual Seminar in Industrial Property for participants of Latin America. In the bilateral level, INPI has among others, cooperation agreements with France, Paraguay and Uruguay, which involves training, consulting and exchange of information.

5. Lessons from American's Experience

Contrary to perspectives that the United States has always been a *laissez-faire*, totally market-based economy, the federal government has long been involved with aiding business and, more recently, with technology-based industrial policy. Over time, this involvement has taken on several different dimensions.

In a boarder sense, the federal government was prominently involved in promoting commerce through the establishment and protection of property rights. An entire new school of political economy and law/economics has focused on the important role played by the explication, delineation, and enforcement of property rights and contracts in economic development (JOHNSON and TESKE, 1997).

The federal government's first major endeavor in this area came with the Land-Grant College Act of 1862, which provided land and financial support for the establishment of a university in each state dedicated to agricultural and mechanical studies.

World War I provided the impetus for much more intensive government involvement in private business by shifting the American economy from predominantly agricultural to predominantly industrial. Given the necessity for large-scale war planning and industrial coordination, President Woodrow Wilson established the War Planning Board and temporarily nationalized some infrastructural industries for the war effort.

World War II also helped to clarify the increasingly critical role of technology in military affairs. From new methods of identification (radar and sonar), communication (microwave radio signals), and weapons of mass destruction (the atomic bomb), war became more technologically sophisticated. The federal government recognized that to develop these technologies, it needed federal laboratories filled with the best scientists.

After World War II, Congress established the National Science Foundation (NSF) to fund basic academic research at universities. The Soviet launching of Sputnik in 1957 challenged the superiority of American research in space and aeronautics. Congress responded by expanding technology education in the 1958 National Defense Education Act, by establishing the Defense Advanced Research Project Administration (DARPA), and then by establishing NASA, the National Aeronautics and Space Administration.

The next major post-World War II catalyst for federal research efforts came after the oil-supply problems created by the 1973 Arab oil embargo. In 1977, Congress established the Department of

Energy, a major role of which was to support research into alternative energy resources and improve the utilization and conservation of existing supplies.

In recent years, there has been a variety of federal legislative programs and activities to promote the transfer of technology, products, and processes, skills, and knowledge from federal laboratories to the private sector. It has been estimated that less than 5 % of the 30,000 patents granted to the federal government have been developed into commercial products (GUTTERMAN & ERLICH, 1997).

Beginning in 1980, a variety of legislative initiatives have been passed aimed at more fully optimizing the private sector's use of federal laboratory research results and capabilities. The Bayh-Dole Act of 1980 was the first major attempt to increase America's use of government technology.

The Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) provided the federal departments, agencies, and the affiliated laboratories with a legislative mandate to pursue technology transfer activities.

5.1. Public Law 96-517, the "Bayh-Dole" Act

The Bayh-Dole Act created a uniform patent policy among the many federal agencies that fund research, enabling small businesses and non-profit organizations, including universities, to retain title to inventions made under federally-funded research programs.

Some of the major provisions of the Act include:

- Non-profits, including universities, and small businesses may elect to retain title to innovations developed under federally-funded research programs;
- Universities are encouraged to collaborate with commercial concerns to promote the utilization of inventions arising from federal funding;

- Universities are expected to give licensing preference to small businesses;
- The government retains a non-exclusive license to practice the patent throughout the world;
- The government retains march-in rights.

The Bayh-Dole Act and subsequent amendments provide the basis for current university technology transfer practices. The federal patent and licensing policy was shaped by four events which occurred between 1980 and 1985:

1. On December 12, 1980, P.L. 96-517, the Bayh-Dole Act was enacted into law. This statute contains several important provisions:
    - A uniform federal patent policy was established;
    - Universities were encouraged to collaborate with commercial concerns to promote the utilization of inventions arising from federal funding;
    - It was clearly stated that universities may elect to retain title to inventions developed through governmental funding;
    - Universities must file patents on inventions they elect to own;
    - The government retains a non-exclusive license to practice the invention throughout the world;
    - The government retains march-in rights;
    - Preference in licensing must be given to small business;
    - Uniform guidelines for granting licenses were provided.
2. On February 10, 1982, the Office of Management and Budget issued policy guidance to federal agencies for implementing the Act. This guidance is known as OMB Circular A-124. The government clarified the following provisions:
    - Standard patent rights clauses for use in federal funding agreements;
    - Reporting requirements for universities electing title;

- Special federal rights in inventions.

3. On February 18, 1983, a Presidential Memorandum on "Government Patent Policy" was issued. It mandated broad application of the new government policy. Two significant aspects are:
    - Federal agencies were directed to extend the statutory terms beyond universities and nonprofit organizations to for-profit grantees/contractors as well;
    - The Federal Acquisition Regulations (FAR) were amended on March 30, 1984 to assure that all R&D agencies would implement the Bayh-Dole Act and the Presidential Memorandum.
4. On November 8, 1984, the original statute was amended. The new language, referred to as P.L. 98-620, provides further refinement:
    - The term limitation on exclusive licenses was deleted;
    - The Secretary of Commerce was substituted for the Comptroller General as the responsible party to determine "exceptional circumstances" when contractor rights might be overruled.

In summary, the Bayh-Dole statute and subsequent amendments created incentives for the government, universities, industry and the small business sector, and herein may lie the reason for its success. It was not until 1987, however, that all these provisions - the Bayh-Dole Act, its statutory amendment, the OMB policy guidance and the Presidential Memorandum - were finalized in rulemaking, published by the Department of Commerce. These rules specify the rights and obligations of all parties involved and constitute the operating manual of the modern technology transfer officer.

- In 1980, there were approximately 25-30 universities engaged in technology transfer; by 1992, there were 200;
- Between 1974-1984, 84 universities applied for 4,105 patents (2,944 subsequently issued); in 1992 alone, 139 universities received 1,557 patents;

- During 1974-1984, 1,058 licenses were granted by universities; in the period 0f 1989-1990, 1,510 licenses were granted;
- In 1986, 112 universities reported licensing income of $30 million; in the two year period of 1989 and 1990, 35 universities reported income of $113million;
- According to the General Accounting Office, industrial support of university research has risen from 4% in 1980 to 7% in 1990.

According to the Association of University Technology Managers (AUTM), the Act encouraged universities to participate in technology transfer activities. Prior to Bayh-Dole, fewer than 250 patents were issued to universities each year. In the past few years, U.S. universities participating in the Survey have averaged more than 1,500 patents annually.

Technology transfer-specifically the licensing of innovations-adds more than US$ 33.5 billion to the economy and supports 280,000 jobs each year. It has helped to spawn new businesses, create industries, and open new markets. Furthermore, a 164% increase in new U.S. patent applications and a 120% increase in licenses from FY 1991 – FY 1998 indicate that the transfer of technology from academic institutions to the private sector will continue to grow in the next decade, generating future economic growth and health benefits (AUTM, 2000).

These data lead clearly to the conclusion that the Bayh-Dole Act has promoted a substantial increase in technology transfer from universities to industry, and ultimately to the public, as products become generally available. The Act provided a secure base to which universities could link to some of their key research projects. Certainty of title to inventions made under federal funding proved to be most significant. While allowing commercialization, title also protects a researcher's rights to use and continue to build on a specific line of inquiry. Implementation of uniform patent and licensing procedures became the second ingredient for success. This combination of factors led to a tremendous boost in university technology transfer activities.

5.2. Changes in the Academic Landscape due to the "Bayh-Dole" Act

Before the passage of the Act, many academic institutions did not aggressively pursue intellectual property protection for their inventions. One reason for this was that many such inventions were created with the aid of federal funds, and the majority of the statutes which provided for federal funding for research mandated that the results be contributed to the public domain. Inventions created in pre-Act academia which were not the result of federal funding may also not have been patented because of the perceived high cost of obtaining patents, and the lack of specialized skills and knowledge at each institution to evaluate the advisability of patenting particular inventions and thereafter prosecuting patent applications. Additionally, prior to the Act, most institutions lacked clear policies on the sharing of licensing income with inventors, and thus inventors did not have a strong incentive to disclose their inventions.

The Act addressed these problems by setting a national policy regarding inventions which are created in the course of federally funded research. Essentially, the Act provides that the title to such inventions should remain with the funded organization that performed the research, and that such inventions should be patented and exploited, subject to certain limited exceptions and exclusions, such as "march-in rights", and the granting of confirmatory government licenses. March-in rights are rights reserved to the government to compel an inventor that is subject to the Act to grant licenses to third parties if the inventor is not diligently commercializing her or his invention. Confirmatory licenses are another requirement of the Act, which require inventors to grant to the federal government the right to use the invention.

The Act also provides that universities must share licensing revenues with the inventors of each technology, respectively. In sum, the post-Act era has seen a remarkable shift in American universities' intellectual property strategies.

One direct result of the Act was that American universities developed technology transfer offices. Since the Act mandated that universities protect such a substantial number of potentially patentable inventions, it suddenly became more economical for such institutions to run these offices, which are staffed by people with the specialized skill sets to develop, manage and commercialize often large and complex intellectual property portfolios covering both those inventions which arise out of federally funded projects and those that were developed without such funds.

Additionally, since the time of adoption of the Act, the amount of funding provided by certain states to public universities has diminished. This has forced state universities to focus more closely on other sources of revenue generation, such as technology licensing. Several institutions have also demonstrated the ability to generate significant revenue from their research activities, which has in turn generated interest from their peer institutions. For example, the University of Florida receives substantial revenues each year from the licensing of its rights in Gatorade, which was originally created by scientists there. Additionally, according to the Report, licensing income to American universities in the 1996 fiscal year totaled $365.2 million, representing an 22.1 % increase over the year before. These statistics, which demonstrate the potential for vast profits, have encouraged other institutions to invest in building their research capabilities as well as their technology transfer infrastructure.

5.2.1 Modern Licensing Approaches Applied in the Era of Bayh-Dole

One of the primary objectives of the Act was to encourage cooperation between federally funded research groups within non-profit organizations and federal agencies on the one hand, and small businesses on the other. The various approaches now used by universities, as licensors, to provide their technologies to start-up companies may be divided into three broad categories, although in actual practice, institutions usually find their own mix of the strategies. We shall refer to the three broad categories as “classic licensing”, “equity licensing” and “the incubator approach”. The classic licensing approach was the approach that was first adopted by American universities in the early 1980s; equity licensing and the incubator approach are newer, more creative strategies.

Classical Licensing

In a classic license transaction, the licensor receives royalties based on the sales or projected sales of the product which is covered by, or produced, using the licensed technology. Payments are usually broken up in varying degrees between up-front payments and ongoing payments based on actual sales or projected sales of Licensed Products. From the licensor's perspective, this structure is the most conservative, as the Licensor will usually try to negotiate a substantial payment up-front, and minimum annual royalties thereafter.

In the past as well as today, almost all universities practice this approach to licensing as their first choice when licensing out technologies. The classic licensing approach provides the licensor with a measure of predictability and assurance with respect to future revenues by giving the licensor certain payments, and the licensee's commitment to pay in the future, but prior to the completion of the product development cycle. In this way, the Licensor is essentially passing to the licensee the risk associated with developing the new technology. Such an approach benefits the licensor by providing the licensor with immediate cash benefits, and some speculative future upside if the product is successfully commercialized.

From a start-up company's perspective however, such a structure presents several problems. First and foremost is the fact that, as the licensee, a start-up often does not have extensive amounts of capital, and to the extent that the licensed technology is not yet ready for market, the licensee would prefer to devote its financial resources to research and product development activities, rather than to paying minimum royalties and up-front payments to the licensor (in contrast, many of the larger and more established companies that choose to take licenses from a university are able to afford to make significant pre-commercialization expenses). Universities have appreciated this fact and have in turn come to consider alternative approaches.

As an example, Stanford, according to its web-site, in certain limited circumstances may consider licensing start-up companies on terms that include very little, if any, pre-commercialization payments in order to facilitate the start-up company's ability to develop and commercialize a technology. Additionally, in connection with the classic licensing approach as well as the other approaches discussed below, many institutions will allow potential licensees to take a “test-drive” of certain technologies, granting a license for a limited period so that the licensee can evaluate the technology.

While universities have recently widened their horizons and become more friendly to entrepreneurs and start-ups as licensees, they have also become more sophisticated and aggressive in their licensing practices. Some universities have become more focused upon setting development and commercialization milestones which toll payment obligations, and setting forth requirements for the licensee's diligent development of the Licensed Products.

Equity Licensing

The equity licensing model was developed as a creative solution to the key problem highlighted above for classic licensing: the requirement that the licensee make payments to the licensor prior to accruing revenues from the sales of Licensed Product. The equity licensing approach involves a grant to the licensor of an equity interest (shares of the start-up company's stock) in the start-up company in partial consideration for the grant of the license. Usually, such a grant of stock will be in addition to the ongoing responsibility to pay royalties to the licensor on actual sales of Licensed Products. One can therefore view the grant of stock as a substitute for some or all of the pre-commercialization payments that the licensee might otherwise have been forced to pay.

This approach has many advantages to both the licensor and to the licensee. The equity licensing approach is advantageous in the short run due to the licensee's increased ability to immediately devote its resources to taking what is often an early stage technology, and performing the further development work that is required in order to transform it into a commercial product. Also, the licensee may reap the benefits of commercializing the product sooner, and the licensor may see both royalties on the sales of the Licensed Products, and the appreciation of the licensor's equity interest in the start-up company, as well as any dividends which could be paid out from the company as profitability is attained.

The equity licensing approach has another advantage for both of the parties to the transaction, in that the equity approach has the effect of more fully aligning the interests of the parties. In the classic licensing approach, the licensor will be most closely focused upon the commercialization of the Licensed Product, and the royalties or other payments related to the license. Thus a licensor may pressure the licensee into taking actions which may benefit the licensor in the short term, possibly at the expense of both parties' long term interests. Under the equity licensing approach, however, this is less likely to occur since the licensor has a financial interest in the overall success of the licensee.

While the equity licensing approach has certain advantages, it also has certain disadvantages. First, the licensor will have to perform a far greater amount of due diligence on the licensee in order to attain a comfort level high enough to forego a cash payment in favor of an equity interest in the licensee. In particular, the licensor will need to obtain a high degree of confidence in the members of management and the board of directors of the start-up company. This is in contrast to the situation in a classic licensing context in which a university may be comfortable granting a license to an unknown entity if the up-front payments are sufficiently favorable.

Another problem with the equity licensing approach is that unlike cash income, which is liquid, and susceptible to definitive valuation, equities, particularly equities in privately held start-up companies, are neither liquid nor capable of definitive valuation. Thus, such equities cannot be used immediately by the university to offset its costs, such as for patent prosecution and maintenance. At some institutions, separate legal entities have been established to hold the stock from these types of arrangements, with such steps requiring further administrative overhead for the institution.

According to their web sites, as examples, some variations upon the equity licensing approach are used at the following institutions: Harvard University, University of Michigan, and M.I.T. M.I.T. has been particularly successful in their out-licensing activities using both the classic approach as well as its own variation on the equity licensing approach. For example, according to its web-site, in the 1997 fiscal year, eight start-up companies were founded based on M.I.T. technologies, and the institution received $21.2 million in revenue from its licensing activities, including $5.8 million in equities.

The Incubator Approach

A third approach to commercializing federally funded university research results is the incubator approach. This approach involves the founding and support of start-up companies or virtual companies by the institution, and often also involves a technology transfer. According to an article in the December 15, 1997 issue of BusinessWeek, of the roughly 550 business incubators in the U.S., 13% are run by or in conjunction with a university. Incubators usually provide space for offices and laboratories and may provide some level of funding and administrative support to help the start-up or virtual company get off the ground. Such support may also include assistance in the development of a business plan, help in obtaining venture financing, and business counseling services. One example of a university which has actively used the incubator approach is Columbia University which, according to the October 20, 1995 Columbia Record, in cooperation with New York City and the State of New York, has recently developed a $28 million biotechnology incubator complex in the Washington Heights section of New York City. As with the Columbia University project, incubators often involve a cooperative effort between an academic institution and state or federal government agencies.

The incubator approach has many advantages, one of the greatest being that by keeping a given technology within the institution for a greater portion of the development process, the institution substantially increases the value of the technology, and hence the potential payments it may receive for such technology. Additionally, since many inventors in the academic world have neither the capital nor the business expertise to successfully start up their own technology companies, the advice and financial support of a business incubator can make the difference between success and failure for a given technology.

5.3. Public Law 96-480, the "Stevenson-Wydler" Technology Innovation Act

The Stevenson-Wydler Technology Innovation Act of 1980 specifically states that the federal government is responsible to ensure "full use of the results of the nation's federal investment in research and development," and mandates that, where appropriate, it may transfer technology to state and local governments and the private sector by the following methods:

1. Establishing organizations in the executive branch to study and stimulate technology;
2. Promoting technology development by establishing centers for industrial technology;
3. Establishing the Offices of Research and Technology Applications (ORTAs) within the federal laboratories to disseminate information about federal products, processes, and services;
4. Providing for each federal agency to make available not less than 0.5 % of its R&D budget for transfer activities, thereby stimulating improved use of federally funded technology developments by state and local governments and the private sector;
5. Recognizing persons and companies that have contributed significantly in technology;
6. Encouraging the exchange of scientific and technical people among academia, industry, and federal laboratories.

The Federal Technology Transfer Act of 1986 (P.L. 99-502) which was actually an amendment to the Stevenson-Wydler Act, was an attempt by Congress to further open the federal laboratories to cooperative research. This law gave agencies authority to conduct cooperative research with outside parties and negotiate patents licenses. In addition, it set further guidelines for technology transfer and established the Federal Laboratory Consortium (FLC) for technology transfer with a formal charter. This act provides the fundamental guidance for federal technology transfer, and the primary points in the law can be summarized as follows:

1. It gives agency and laboratories directors latitude to enter into Cooperative Research and Development Agreements (CRDAs or CRADAs) and to negotiate patent license.
   - It authorizes exchange of people, services, facilities, equipment, or other resources to conduct specified R&D efforts consistent with the laboratory mission;

- It does not include procurement contracts or grants;
- It gives preference to small business and business who agree to manufacture CRDA development in the United States.

2. It permits royalty income from patent licensing and assignment to be distributed directly to the inventor(s) and producing laboratory.
   - At least 15 % of the royalties must be paid to the inventor(s);
   - Virtually the entire balance of the royalties go to the laboratory to be used for additional awards, incidental expenses, or further scientific exchange or education/training consistent with the mission.
3. It makes technology transfer a job requirement of every laboratory scientist and engineer.
   - Management must positively consider technology transfer in job descriptions, performance evaluations, and promotions;
   - Laboratories must establish a cash award program to reward employees for technology transfer accomplishments, inventions, and other scientific achievements.
4. It increases ORTA involvement in laboratory management development programs.
   - It requires at least one full-time equivalent ORTA position for each laboratory having 200 or more full-time scientific, engineering, and related positions;
   - Managers must include ORTA people in overall laboratory management development programs to ensure full participation by managers in technology transfer processes;
   - ORTA employees are to participate, where feasible, in regional, state, or local technology transfer efforts.
5. It provides a home for the FLC within the National Institute of Standards and Technology (NIST).
   - The FLC will use 10 % of its budget for demonstration projects in technology transfe;

- The FLC will not engage directly in transfer of technology but will support and help laboratories in this function.

5.4. Technology Transfer Offices Roles

5.4.1. General Guidelines and Policies

Regardless of the formal structure used by the university to manage its technology development activities, the decisions which are made are generally guided by internal policies formulated by university administrators relating to intellectual property which may be created by university personnel and students.

The policy will be generally be administered by an advisory committee which includes a university administrator with responsibility for research activities, the manager of the university's technology transfer function, and one or more representatives from the department(s) in which the research activity are being conducted. University employees and students involved in developing inventions or technical information which may be eligible for intellectual property protection would be required to disclose to the advisory committee specified information regarding any invention or technical information. The advisory committee would review each disclosure and make a recommendation to university administrators as to the university's role, if any, in the further commercial development of the invention or technical information.

If the university pursues a relationship with outside agents, royalties and license fees will be determined in the negotiations with the agent. However, in those cases where an inventor has the right to independently pursue commercialization of the invention, the inventor will be allowed to retain all royalties and license fees, subject to an obligation to reimburse the reimburse the university for the cost of any special support which facilitated the development effort. If the university does retain an interest with respect to the commercialization of an invention or any technical information, provision will usually be made to share the proceeds of such interest with the inventor, as well as with the inventor's department. For example, the policy might provide that the first US$ 10 thousand in royalties and license fees from the discovery be shared 50 % to the inventor, 25 % to the inventor's department, and 25 % to the university. Additional amounts might be shared 25 % to the inventor, 30 % to the inventor's department, and 45 % to the university. The purpose is to provide an incentive to university researchers to engage in activities which might have commercial application.

The policy may cover a number of other matters designed to ensure that an appropriate balance is achieved between the desire to obtain the benefits of commercialization of university research and the university's mission to disseminate new ideas and works to the general public. Negotiators on behalf of the university will be admonished to attempt to structure contracts with out-side agents in a manner which provides the greatest degree of latitude to the university and the inventor with regard to publishing the results of the research work. The policy will also cover any consulting arrangements involving university personnel and private firms, with university personnel being held responsible for ensuring that the consulting arrangements do not conflict with the overall policies of the university.

The major steps in technology transfer are: disclosure of inventions; record keeping and management; evaluation and marketing; patent prosecution; negotiation of license agreements; and management of active licenses. University technology transfer is mainly a system of disclosure, patenting, licensing and enforcement of patents and licenses.

5.4.2. Disclosing the Invention

The disclosure document contains information about the invention, the inventors, the funding sources, anticipated bars to patenting such as publications, and other data such as likely candidates for licensing. The disclosure is reviewed by the licensing staff or a university committee, who make a preliminary decision about ownership and the invention's potential commercial value and patentability. The technology transfer office takes action to insure that the newly disclosed intellectual property will be handled in compliance with federal and university policies.

5.4.3. Patenting the Invention

After disclosing, the next step is to seek an opinion on the patentability or to file a patent outright. In case of file a patent, the preferred layout of a patent specification varies from country to country, but usually has the following features:

- **A title page:** The bibliographic information is labeled by internationally agreed numerical codes. If the specification is headed "Patent" or "Patent Specification", then it refers to a patent that has indeed been granted. But if it is headed "Patent Application", "Publication", or something similar, then it refers to an application that, at the time of printing it, had not been granted and therefore conferred no monopoly rights on anybody as of that time, but such rights may be backdated when an application is granted.
- **An abstract:** Provided to assist searchers. It has no legal significance.
- **An opening paragraph:** Indicates the technical area of the invention
- **Background remarks:** Set the scene, explain what problem has been overcome, and refer to relevant previous publications.

- **A statement of invention:** Defines the invention in general, but precise, terms. Also introduces preferred options within that definition. Usually the wording is the same as the Claims.
- **A specific description:** Often introduced by wording such as “The invention will now be described by way of example,” followed by a formal listing of any figures. This specific description then relates in detail how the invention can be carried out; it can refer to very specific detail, such as an exact temperature, but does not limit the scope of the patent to the use of that temperature. The specific description is the usual way for the applicant to discharge his responsibility to inform the public adequately how to carry out the invention, which they will be free to do after the patent ceases.
- **Claims:** These define the invention. Nothing falling within the definition should be known or obvious. This is why there are usually several successively narrower Claims in a patent: If one of the Claims does indeed turn out to define something that was already known, the features from another Claim can come to the rescue. The language of a Claim is intended to make clear-cut what activities are, and are not, within that Claim. An unauthorized activity that coincides with all of the words of a Claim of a granted patent is an infringement of that patent.

5.4.4. Evaluating and Marketing

Valuation of intellectual assets is an inexact science. No single technique is accepted as a “the best.” Different valuation techniques can result in values which differ by as much as a factor of two. Accurate, useful, and defensible valuations require the selection of a methodology appropriate to the circumstances and applied with as much analytical rigor as the sources of input data will allow. Table 1 illustrates the different methods to value intellectual properties. In valuation, every intellectual property is unique by nature. This table is a summary of the situations in which technology needs to be valued along with corresponding recommended valuation methods.

Table 1 Methods for Valuing Technology

Method	Advantages	Disadvantages	When
25% Rule	Simple	Does not consider: ▪ Potential profitability ▪ Risk/fair return on investment	Quick rough estimate
Market	Very credible technique	▪ Assumes current industry norms are correct ▪ Existence of an active market with similar technologies ▪ Companies with similar product (extrapolate) ▪ Indirect approach of valuation[1] ▪ High cost of obtaining accurate data from previous industry deals	If there is a comparable, this is the preferred method, as long as the disadvantages are addressed.
Return on sales	▪ Quick ▪ Established industry norms exist	▪ Difficult to determine proper allocation of profits between two parties ▪ Value could be different from company to company ▪ Does not consider investment risk	▪ Established industry norms are present ▪ Sales projection are agreed on.
Cost	Quick/definable	▪ Revenue not related to value of intellectual asset ▪ Imprecise/may under value technology ▪ Viable for technology developed beyond semicommercial scale	A companion methodology used in negotiations.
Auction	▪ Direct determination of willing buyer ▪ No calculation is necessary	▪ Less control of the willing seller to set the price ▪ Choice may not go to the buyer that is most compatible or may not commit to commercialization	▪ There are many interested buyers ▪ Low negotiation resource commitment on seller's part is desired ▪ Targeted at up-front payments
Income/Discounted Cash Flow	▪ Most accepted method in marketplace ▪ Cash flow streams from all potential revenue ▪ Takes into consideration competitive environment stage of the project development	▪ Significant knowledge of competitive environment ▪ Information usually needed from other parties on market dynamics ▪ Detailed knowledge of business and market plan ▪ Time consuming to get accurate data	▪ Unique technologies ▪ Can be applied at any stage of development ▪ Both parties have sophisticated licensing capabilities
Risk Hurdle Rate	▪ Mathematical risk analysis ▪ Easy to determine risk based on stage of development	▪ Intensive mathematical calculation ▪ Fail to address the full potential of the technology within the business enterprise or the competitive environment	▪ An investment bank approach ▪ Financial investment focus ▪ Early stage project
Technology Factor	▪ Gains internal consensus ▪ Isolates the incremental cash flow instead of total revenue ▪ Incorporates the attributes from other methods ▪ Methodological/systematic ▪ Easy to use ▪ Tool considers business enterprise	▪ Requires assembly of a multifunctional team of experts ▪ Significant knowledge of competitive environment ▪ Detailed knowledge of business and market plan	▪ For internal valuations ▪ Could be used for one patent or many related patents/technologies ▪ Could be used for any circumstance ▪ Used with any other valuation method

Source: (SULLIVAN, 1998)

[1]Value of enterprise – working capital – tangible assets = intangible assets (trademarks, distribution, work force, patents, etc.)

The technology transfer office markets the invention to industry. A nonconfidential summary is sent to companies that are likely to be interested. If a company expresses interest, it will be asked to sign a secrecy agreement prior to receiving confidential information from the university. If the company continues to be interested after reviewing the confidential information, an agreement with the company is negotiate. This can be a letter of intent; an option; or a license.

5.4.5. Negotiating a License Agreement

Most university inventions are embryonic and require further research and development before they are ready for the market place. Thus, there is a high level of risk for the licensee – a fact that is taken into account in the licensing negotiation.

License fees and royalties are determined by arm’s length negotiations between licensor and licensee. Fees and royalty are rarely large because most of the technology is in early stages and risky, thus requiring considerable investment to transform it into a marketable product. There are, however, a few technologies that have clear commercial applications and have large potential markets. In such cases, the university can negotiate larger fees and higher royalty rates. The deciding factors are: the type of technology, its stage of development, the size of the potential market, the profit margin for the anticipated product, the amount of perceived risk, the strength of the patents, and the projected cost of bringing a product to market.

To place this in perspective, license fees rarely reach into the six figures for a single patent, but more often range from a few thousand to a few tens of thousands of dollars. Royalty rates range from less than 1 % (for some process technologies) to perhaps 8 % (for patented compound with a significant market). The majority of royalty rates are in the 3 to 6 % range, based on net sales.

Many universities seek to accomplish several basic goals in development of the package of considerations: a) the licensee should fund the patent application either through an up-front fee for reimbursement of costs already incurred by the university or through a requirement to reimbursement of ongoing expenses of the university; b) the license agreement should include ongoing considerations to the university (a royalty); c) required minimum annual royalties after a specified period of time regardless of actual sales; and d) performance milestones to assure that the university's technology enters the market. This "formula" hopefully assures that the technology is developed to completion and put in the stream of commerce, assures a fair return to the university, and assures that the technology is returned to the university should the licensee not pay the minimums or achieve the specified performance milestones.

University decisions on whether to license a patent only to one company or to a number of companies are based on several factors. However, universities are generally most influenced by two major determinants: (1) what kind of licensing is most likely to lead to rapid commercialization; and (2) what kind of licensing is in the public interest.

Patents which are broad in scope and can be used in multiple industries, or patents that are so basic that they form the building blocks for new technologies are most likely to be licensed non-exclusively, or by fields of use. An exclusive, "field-of-use" license is a way to protect a market for a company while enabling the university to identify more than one license to assure public utilization of the technology in all markets.

Non-exclusive licensing is preferred by universities when the technology can be used to foster product development in many fields of use. For example, if a technology will be of greatest benefit to the public if it becomes an industry standard, the university will make it readily accessible to all interested parties.

Universities most frequently will grant exclusive licenses to patents that require significant private investment to reach the marketplace or are so embryonic that exclusivity is necessary to induce the investment needed to determine utility. Frequently, these are new drugs requiring time-intensive and capital-intensive development or they are technologies that have only a tenuous link between the workbench and production. As such, they require a company willing to dedicate financial backing and the creativity of its own scientists on a long-range basis.

At the final call, the decision to license on an exclusive or non-exclusive basis is inevitably driven by market interest. Not only does the interest relate to the value of the invention, but also to the investment required to develop new products and the risk associated with that technology.

6. Power Sector R&D Programs

6.1 Introduction

As competition in the energy utility industries increases, cost pressures increase and new unregulated entities enter the business. As a result there is a shift in utilities' attention to competitive issues that translates into increasing emphasis on being the low-cost provider and greater demand for immediate low-risk R&D investment return. Indeed, utilities have begun to focus their R&D investments on shorter-term competitive issues. The overall result is a trend toward reduced R&D investment and the elimination of some longer-range programs that would have provided less immediate competitive advantage. This trend is especially marked in California where utility R&D investments fell by more than 50 % after the California Public Utility Commission issued its initial order proposing to increase competition in the electric industry by restructuring (MORGAN and TIERNEY, 1998).

Some observers anticipate that this trend will continue in the more competitive environment that results from restructuring and that overall investment in R&D will decline. Others believe that, after restructuring is complete, competition will stimulate renewed R&D investment. Regardless of which view is held, most agree that there will be few clear incentives for a firm to invest extensively in R&D that has benefits that are non-proprietary and largely external to the firm. This is a concern because there may be a body of important R&D that will not be adequately provided for by the competitive market since some or all of its benefits are widely distributed and cannot be captured by individual companies.

For historical and structural reasons, the power industry never developed a vigorous research institution as the telecommunication sector and for many years invested a small percentage of its revenues in research of any kind. Even in recent years, firms in the electric industry in the U.S. have spent as little as 0.2 % of their net sales on R&D, whereas the pharmaceutical, telecommunications, and computer industries spend between 8 and 10 % (MORGAN and TIERNEY, 1998).

The aftermath of the 1966 blackout in the northeast, which brought the threat of congressionally mandated research, finally induced the industry to create the Electric Power Research Institute (EPRI). Today EPRI stands as one of the most successful examples of a collaborative industry research institution. But for a number of reasons, including the historically more limited research tradition of the power industry, pressures from a number of quarters for rapid results, and the dominant role of practically oriented engineers, it has always favored applied research. Nothing like the transistor, radio astronomy, and the stream of other contributions to basic science and technology that flowed from the work of the old Bell Telephone Laboratories has emerged from EPRI. Of course, with the introduction of competition to the telecommunications industry, Bell Labs has been restructured and no longer operates as it once did.

Additionally, civilian nuclear power would never have happened without defense-motivated investments in nuclear weapons and ship propulsion as well as investments in civilian nuclear power by the Atomic Energy Commission and the Department of Energy (DOE). Similarly, the combustion turbines that are the technology of choice for much new power generation today are derived from aircraft engines. The basic technology underpinnings for FACTS technology, fuel cells, and photovoltaics also did not come from research supported by the power industry. These technologies are the outgrowth of developments in sectors such as the civilian space program, intelligence, and defense.

Within the power industry, neither the electric equipment suppliers nor traditional power companies can be expected to support significant investments in basic technology research in the next few years. From 1995 to 1996, the American electric and gas industry reduced private R&D funding in absolute terms and cut basic research by two-thirds (MORGAN & TIERNEY, 1998).

In short, the result is that current investments in basic technology research related to electric power and more generally to networked energy systems are modest. Without policy intervention, they are likely to stay that way.

In Brazil, the ANEEL's first endeavor in R&D was the inclusion, in the utilities' contracts of concession, of a new clause for investment in R&D programs. The minimum mandated investment is a percentage of annual net revenue for distributors and generators, which are 0.1 and 0.25, respectively.

In 1998, ANEEL issued the Resolution 242/98 to support programs in R&D, in addition to energy efficiency programs. The R&D programs should meet very simple criteria for eligibility, set forth in the "Manual para Elaboração de Programas de Pesquisa e Desenvolvimento Tecnológico do Setor Elétrico Brasileiro." (ANEEL, 1999).

On July 24, 2000, President Cardoso approved Law 9,991, which increases the resources that must be spent by utility companies; moreover, the law requires all players in the networked power industry, including transmission companies, to make investments in R&D. The new percentages under Law 9,991 start at 0.50 % in 2000 and increase to 0.75% by 2006 for distributors and 1.0 % for generators and transmission utilities. Finally, the new law creates a funding mechanism for supporting a public good, such as environmental and energy-related basic technological research. The amount of money to be collected, to support public interest R&D, represents 50% of the total mandatory investments in R&D imposed on the power sector.

The Ministry of Science and Technology will establish an Advisory Council to define general guidelines and annual investment plans, as well as to oversee the R&D effort. The Council will be composed as follows:

- Three representatives from the Ministry of Science and Technology. Of these, the first will be from Central Administration, who will preside over the Committee; the second will be from the Brazilian National Research Council (CNPq); and the third will be from the Brazilian Federal Agency for Financing Studies and Projects (FINEP);
- One representative from the Ministry of Mines and Energy;
- One representative from the ANEEL;
- Two representatives from the Scientific and Technological Community;
- Two representatives from the Power Industry.

In summary, the Brazilian policymakers have created a mix of private and public R&D spending for the power sector. As a result, these two innovation models will function in parallel to each other; the technology-push model argues that innovation is driven by scientific research, and the technology-pull model counters that innovation is driven by market forces. Thus, Publicly-Funded R&D should provide support for research in areas with a long-term focus and a broad distribution of benefits. On the other hand, utility companies might focus on short-term issues of efficiency and cost control.

6.2. Publicly Funded R&D

The Ministry of Science and Technology have launched a set of funding mechanisms to address specific economy sectors: gas and oil, energy, transportation, water resources, mineral resources and aerospace. The Decree that regulates Law 9,991 has not been issued; furthermore the Advisory Council, described in the previous section, has not been established yet. Therefore, in the following paragraphs it will be described the experience of California state which has established a funding mechanism for 3 years. The Californian approach could shed some light to this issue in Brazil.

The Public Interest Energy Research (PIER) program was established in January 1998 to conduct energy research, development, and demonstration projects for public interest. The California Energy Commission (CEC) receives US$ 61.8 million annually, with the remainder administered by the California Public Utilities Commission (CPUC) for transmission and distribution projects.

The California Energy Commission was assigned to implement most of the PIER program. The CEC has realized some important accomplishments over the last two years, including: establishing a Policy Advisory Council; conducting a transition solicitation that preserved key elements of the utilities's public interest R&D activities; conducting two competitive general solicitations and one targeted programmatic solicitation; and initiating a framework for planning and managing the program into the future. As of December 1999, the CEC had awarded approximately US$ 101.6 million under the PIER program in four competitive solicitations, interagency agreements, and sole source awards (CCST, 2000).

The current PIER program portfolio includes 3 phases (Transition, PIER 1, and PIER 2) and the Energy Innovations Small grants program. The transition phase was intended to preserve public interest R&D previously funded by investor-owned utilities while PIER program implementation began. Competitive bids were limited to the three investor-owned utilities in the state and the California Institute for Energy Efficiency. The CEC received 62 proposals, of which 39 projects valued at US$ 17million were awarded contracts.

The two general solicitations provided an adequate beginning to a broader PIER program. CEC received 180 proposals in response to the PIER 1 general solicitation in February 1998. The proposals covered three program areas: Renewable Generation, Environmentally Preferred Advanced Generation, and Energy-related Environmental Research. In June 1998, 20 of these projects were approved, value at US$ 18.3 million in PIER funding. In April 1998, the CEC released the PIER 2 general solicitation covering the remaining program areas of End-use Energy Efficiency, Industry / Agriculture / Water, and Strategic Research. The CEC received 169 proposals, and in October 1998, approved 24 of these for contracts, valued at US$ 48 million in matching funds were proposed.

The Energy Innovations Small Grant program awards up to US$ 75,000 each to small businesses, small non-profits, individuals, and academic institutions proposing projects that establish the feasibility of R&D concepts related to the PIER program. The grant program resides within the Strategic Program Area, but is administered by the California State University Institute through an inter-agency agreement with the CEC. It is funded at US$ 2.5 million annually with US$ 2 million available for grants, and has released three solicitations since March 1999, resulting in 216 proposals received. As of December 1999, 18 projects valued at US$ 1.35 million have been approved.

Despite its successes, the PIER program has suffered from a variety of problems hindering effective program execution. These include:

- The lack of a program director responsible for program planning and execution for 20 of the 24 months since the beginning of the program;
- A mismatch and lack of clarity between responsibilities, authority and assets for the program area managers;
- Limited coordination among CEC elements supporting the program;
- An overly complex and time-consuming contracting process for PIER projects;

- Unclear connection among other federal and private-sector energy R&D activities, California's future energy-related needs, program goals, and public interest criteria.

The CEC has attempted to address some of these issues by establishing the position of PIER Program Manager, filing that position, and developing a process that more closely links future energy-related challenges to program objectives and public interest criteria.

However, the root cause of any of these problems appears to be inherent in the current nature of the CEC, and in how CEC implements its rules and procedures. Although the CEC has historically conducted planning, policy, R&D management, and regulatory functions, its organizational culture tends to be risk averse, with an emphasis on due process and consensus building.

6.3. Industry-financed R&D

This section is based upon an ongoing implementation of power sector R&D policies and programs. Besides the assessment of the first year program, there are still many steps to be properly conducted in order to stimulate innovation.

Before Law 9,991 was enacted, only some utilities had invested in R&D programs. The ANEEL's statute provided directives for utilities to elaborate their R&D programs. The ANEEL is responsible for analyzing, approving, and overseeing the program's implementation.

A relatively simple management procedure requires that utilities designate a person to serve as the project manager with respect to each research project. The whole program constitutes as many projects as the utility decides to include in its portfolio. The utility companies may conduct the projects in a partnership with universities, research institutions, consulting companies, and electric equipment suppliers.

In 1999, 13 companies invested in 62 research projects the amount of US $ 7 million, of which 76% funded collaborative research between industry and universities and industry and research institutions; the projects covered three programs areas: Strategic Research – 92%, Energy Efficiency – 5%, and Environment – 3%. Currently, 45 companies are investing in 167 research projects the amount of US$ 15 million; of these, approximately 84% are in collaboration with third parties: universities, research institutions, consulting companies, and electric equipment suppliers. As expected, the utilities are investing heavily in Strategic Research – 61.4 % of the resources; however it can be noticed a more diversified portfolio in comparison with the previous year. Thus, the projects included new research areas Renewable Energy – 9.8% and Generation – 10.0 %, along with Energy Efficiency – 12.5% and Environmental – 6.3%.

Taking into account the provision of Law 9,991, the amount of money involved will increase to about US$ 75 million, which could result in a countless number of future projects.

The increasing complexity and diversity of projects, as perceive by ANEEL, have encouraged a movement towards a new institutional arrangement involving the CNPq. ANEEL and CNPq signed an agreement on November 24, 2000. Then CNPq will be in charge of the analysis and oversee the implementation of programs from the years 2001 to 2005.

The CNPq is a private nonprofit foundation, which has promoted research for 49 years. It is tied to the Ministry of Science and Technology. The main activities conducted by CNPq include stimulating research, funding graduate fellowships, and the diffusion of knowledge. Its organizational structure includes a managerial council, an executive director, superintendents, technician-administrative supervisors, and a board of technical experts.

The main goals of this agreement are to:

- Stimulate research in the power sector;
- Increase the power industry's competitiveness;

- Improve the power quality;
- Identify the sectorial technological demands;
- Promote joint research and collaboration between industry and university and industry and R&D institutions;
- Strengthen the IPRs protection.

7. Regulatory Arrangements to Strength Protection for IPRs

Research and development arrangements usually involve a separate contractual agreement between the party providing funding for the research, and the researching party with responsibility for conducting the research project.

Research and development arrangements can take a variety of different forms. In some cases, the research agreement is simply a fee-for-service arrangement which calls for the sponsor to pay a fee to the researching party to conduct specified work over a fixed period of time. In other situations, the research agreement is one of several agreements in a much more complex set of economic relationships between the parties.

As a general rule, the research work will produce a broad variety of tangible and intangible products which may be eligible for protection under the intellectual property laws. The research agreement, between industry and universities and industry and research institutions, should clearly describe the manner which ownership of the inventions, technical information, and any other rights arising out of the research project will be vested.

The confusion in ownership of intellectual property could become a common source of dispute, unless there are clear universities and research institutions policies and definitions within research agreements of the sponsor's rights. University policies commonly state that the university owns all patents and software developed using university facilities or developed under a sponsored research agreement. Industrial sponsors are commonly granted first options to license patents arising from the research.

The research agreement should document the understanding of the parties regarding the ownership of any inventions, technical information, or other items which may be created or discovered in the course of the research program. The agreement should also set out the procedures for protecting the technology, including the steps that will be taken to perfect statutory rights and for ensuring that trade secrets will be maintained in confidence.

Regardless of the formal structure used by a university to manage its technology development activities, one of the most difficult issues in research agreements involving academic institutions is the tension between the need and desire of academic researchers to publish the results of their work and the need of the commercial sponsor to restrict any disclosures which may endanger the competitive utility of the research work or preclude the sponsor from obtaining any legal rights therein. The ability to publish the result of research activities is considered a basic right of academic freedom by universities. While the sponsor may attempt to insist that research results not be published or presented, it is usually sufficient to obtain an agreement that any publication or presentation will be delayed for a limited period of time in order to allow the sponsor to review any planned publication or presentation and suggest any actions which might reasonably be required to protect any of the information contained therein.

Another possible, more formal, arrangement is a contract provision covering publication. It calls for the researching party to deliver the proposed publication or presentation to the sponsor no later than a specified number of days prior to the date that the researching party proposed that publication or presentation be made to the public. The sponsor would then have a fixed number of days to respond to the researching party. If the sponsor does not respond within the period specified, the researching party would be free to make the publication or presentation.

Due to a lack of well established institutional policies regarding the IPRs protection and technology transfer, the issues discussed here – ownership and publicity – are of major concern in the Brazilian Power Sector's Technological R&D Program. Such policies only recently started to be adopted in the country and just a few institutions, like the Federal University of Rio de Janeiro, the Federal University of São Carlos, the Federal University of Pará, the University of São Paulo, the State University of Campinas, the Oswaldo Cruz Foundation and the Brazilian Company for Agricultural and Livestock Research, implemented them (SCHOLZE & CHAMAS, 1998).

Therefore, the building up of an appropriate regulatory framework in the field of intellectual property and technology transfer is an essential step for achieving success of the Power Sector's Technological R&D Program in the future.

A possibility is to set up a technology transfer office to assess inventions, to carry out market studies, to provide legal support within Brazil and abroad, as well as to negotiate agreements and licenses. Such office, which would be created under the guidelines of the current agreement between ANEEL and CNPq, would play the role of the offices described in section 6.4.

CNPq already has experience in this field, since its attorneys are instructed to provide legal assistance to intellectual work resulting from labor contracts signed by CNPq or R&D projects funded by the institution. CNPq passed in 1998 Resolution no. 014, which regulates the IPRs and the inventors share of the economic gains accruing from the commercial exploitation of these rights.

Therefore ANEEL, through CNPq, could provide guidelines and support to the agents – company utilities, universities and research centers – involved in the Power Sector's Technological R&D Program, for the filing of protection requirements, follow up of market penetration of new products, assistance in the negotiation process, and contracting procedures. In the absence of institutional policies for the protection of intellectual property, ANEEL/CNPq could provide such services.

To implement such policy some changes will be required in the procedures set by ANEEL's R&D Guide and a new Resolution should be passed by the Agency. To begin with, in the evaluation process of the proposals the projects which will be developed by utility staff should be set apart from projects which will be run in cooperation with a third party.

In the first case, the IPRs accruing from the projects carried out by the utilities themselves would be automatically protected by the rules set by the proposed technology transfer office.

The same protection from ANEEL is envisaged for cooperative projects when the research institute or university involved does not have an adequate intellectual property protection and technology transfer policy of its own. Otherwise, the agreement reached by the parties will be accepted by ANEEL, which will require, in the project approval procedures, that the contract signed by the parties contemplates the ownership of the IPRs and, in the case of universities, that it will also deal with the publication conditions set for the research results.

Figure 1 illustrates schematically the proposed procedures to regulate the intellectual property protection in the Brazilian Power Sector's Technological R&D Program.

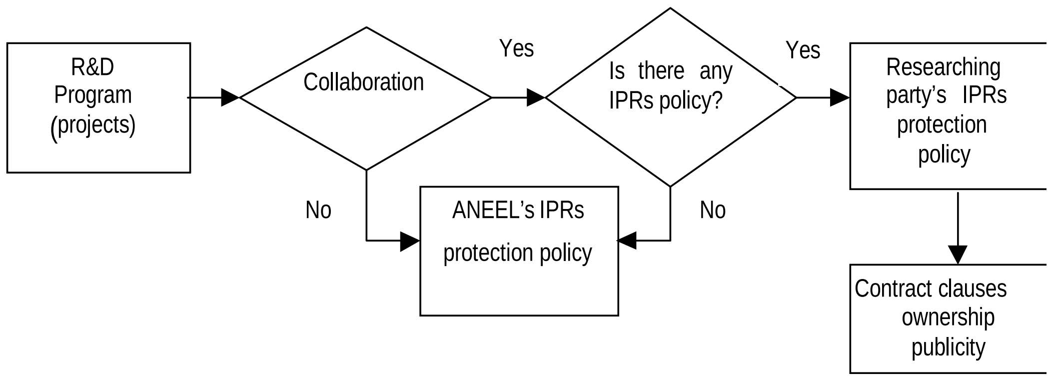

Figure 1 Proposed scheme for intellectual property protection in the Brazilian Power Sector's Technological R&D Program

8. Conclusion

Appropriate protection of intellectual property is a foundation of a successful technological R&D program. It is a fact of business life that private firms develop or acquire new technology for the purpose of gaining or maintaining a competitive edge. They are unlikely to make the investments in product development, manufacture, or marketing necessary to bring that technology to market if they can not protect their intellectual property.

Moreover, an IPRs title defines a legal tool on which the trade and licensing of a technology can be based. The IPRs system thus plays a role in the creation of markets for information and knowledge by providing buyers and sellers of technology with more information. Similar to rights on tangible property, IPRs can make markets for intangible property more efficient and reduce transaction costs.

New laws and regulatory acts were issued bringing the Brazil's protection pattern along with international ones as defined by international treaties. A new law – Law 9,279/96 – came into force on

May, 1997. One very important aspect of this law is related to the protection on sectors where patents were not granted before.

Contrary to perspectives that the United States has always been a *laissez-faire*, totally market-based economy, the federal government has long been involved in promoting commerce through the establishment and protection of property rights. In recent years, there has been a variety of federal legislative programs and activities to promote the transfer of technology, products, and processes, skills, and knowledge from federal laboratories to the private sector. Beginning in 1980, a variety of legislative initiatives have been passed aimed at more fully optimizing the private sector's use of federal laboratory research results and capabilities. The Bayh-Dole Act of 1980 was the first major attempt to increase America's use of government technology.

One of the primary objectives of the Bayh-Dole Act was to encourage cooperation between federally funded research groups within non-profit organizations and federal agencies on the one hand, and small businesses on the other. The various approaches now used by universities, as licensors, to provide their technologies to start-up companies may be divided into three broad categories, although in actual practice, institutions usually find their own mix of the strategies. We shall refer to the three broad categories as "classic licensing", "equity licensing" and "the incubator approach". The classic licensing approach was the approach that was first adopted by American universities in the early 1980s; equity licensing and the incubator approach are newer, more creative strategies.

The Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) provided the federal departments, agencies, and the affiliated laboratories with a legislative mandate to pursue technology transfer activities. The Federal Technology Transfer Act of 1986 (P.L. 99-502) which was actually an amendment to the Stevenson-Wydler Act, was an attempt by Congress to further open the federal laboratories to cooperative research. This law gave agencies authority to conduct cooperative research with outside parties and negotiate patents licenses. In addition, it set further guidelines for technology transfer and established the Federal Laboratory Consortium (FLC) for technology transfer with a formal charter.

As competition in the energy utility industries increases, cost pressures increase and new unregulated entities enter the business. As a result there is a shift in utilities' attention to competitive issues that translates into increasing emphasis on being the low-cost provider and greater demand for immediate low-risk R&D investment return. Indeed, utilities have begun to focus their R&D investments on shorter-term competitive issues. The overall result is a trend toward reduced R&D investment and the elimination of some longer-range programs that would have provided less immediate competitive advantage.

The Brazilian policymakers have created a mix of private and public R&D spending for the power sector. As a result, these two innovation models will function in parallel to each other; the technology-push model argues that innovation is driven by scientific research, and the technology-pull model counters that innovation is driven by market forces. Thus, Publicly-Funded R&D should provide support for research in areas with a long-term focus and a broad distribution of benefits. On the other hand, utility companies might focus on short-term issues of efficiency and cost control.

A technology transfer office could be created under the guidelines of the current agreement between ANEEL and CNPq, to provide protection of IPRs in Brazilian Power Sector's Technological R&D Program.

Therefore ANEEL, through CNPq, could provide guidelines and support to the agents – company utilities, universities and research centers – involved in the Power Sector's Technological R&D Program, for the filing of protection requirements, follow up of market penetration of new products, assistance in the negotiation process, and contracting procedures. In the absence of institutional policies for the protection of intellectual property, ANEEL/CNPq could provide such services.

To implement such policy some changes will be required in the procedures set by ANEEL's R&D Guide and a new Resolution should be passed by the Agency. To begin with, in the evaluation process of the proposals the projects which will be developed by utility staff should be set apart from projects which will be run in cooperation with a third party.

In the first case, the IPRs accruing from the projects carried out by the utilities themselves would be automatically protected by the rules set by the proposed technology transfer office.

The same protection from ANEEL is envisaged for cooperative projects when the research institute or university involved does not have an intellectual property protection and technology transfer policy of its own. Otherwise, the agreement reached by the parties will be accepted by ANEEL, which will require, in the project approval procedures, that the contract signed by the parties contemplates the ownership of the IPRs and, in the case of universities, that it will also deal with the publication conditions set for the research results.

9. References

ANEEL, 1999. Manual para Elaboração de Programas de Pesquisa e Desenvolvimento Tecnológico do Setor Elétrico Brasileiro: ciclo 1999/2000. Agência Nacional de Energia Elétrica, Brasília, 1999.

AUTM, Surveys – Bayh-Dole Act, Association of University Technology Managers, 2000, http://www.autm.net/pubs/survey/facts.html

BLUMSTEIN, C. and WIEL, S., Strategic options for public-interest energy R&D, Discussion Paper, 1997, www.naruc.org/Publications/p&dpaper.htm

CCST, 2000. *California Independent PIER Review Panel Report*, California Council on Science and Technology, March, 2000.

COGR, *University Technology Transfer – Questions and Answers*, Council on Governmental Relations, November, 1993.

COGR, *The Bayh-Dole Act: A Guide to the Law and Implementing Regulations*, Council on Governmental Relations, November 1993.

DAVID, P. A. and FORAY, D., Information distribution and the growth of economically valuable knowledge: A rationale for technological infrastructure policies. In: Morris Teubal, Dominique Foray, Moshe Justman, and Ehud Zuscovitch (Editors), *Technological Infrastructure Policy – An International Perspective*, Kluwer Academic Publishers, The Netherlands, p. 87-139, 1996

ELIAS, S., *Patent, Copyright & Trademark*, Nolo, 3rd ed., 1999

GUTTERMAN, A. S., and ERLICH, J. N., *Technology Development and Transfer – The Transactional and Legal Environment*, Quorum Books, Westport, Connecticut, USA, 1997

INPI, 2000. Instituto Nacional de Propriedade Industrial. http://www.inpi.gov.br

JAGER, M. F., and COOK, W. J., Trade secrets & industrial espionage - Online piracy, 1996, http://www.brinkshofer.com

JOHNSON, R. J. and TESKE, P., Toward an American industrial technology policy. In: Young Lee (Editor), *Technology Transfer and Public Policy*, Quorum Books, Westport, Connecticut, 1997

MASKUS, K. E., *Intellectual Property Rights in the Global Economy*, Institute for International Economics, Washington, DC, 2000

MORGAN, M. G., and TIERNEY, S. F., Research support for the power industry, *Issues in Science and Technology*, Fall 1998, www.nap.edu/issues

PRIMO BRAGA, C. A., FINK, C. and SEPULVEDA, C. P., *Intellectual Property Rights and Economic Development*, Discussion Paper no. 412, The World Bank, Washington, D.C., 2000

SHERWOOD, R. M., SCARTEZINI, V. and SIEMSEN, P. D., Promotion of inventiveness in developing countries through a more advanced patent administration, *IDEA: The Journal of Law and Technology* 39 (4): 473-506, 1999

SHERWOOD, R. M., Patent disclosure and the protection of undisclosed information: A useful dichotomy that propels technology, paper presented at the 20th ABPI Seminar, São Paulo, August 21, 2000

SCHOLZE, S. H. C. and CHAMAS, C. 1998. Regulamentação da Proteção e Transferência de Tecnologia. XX Simpósio de Gestão da Inovação Tecnológica, São Paulo, 1998.

THORNER, B., University technology transfer practices: What's out there for a start-up?, September 1998, www.brobeck.com