Matthew Preiss
Franklin Pierce Law Center
Nonprofit Technology Transfer
Spring 2010

International Application of the Bayh-Dole Act

Introduction

In the 1970s, the U.S. was losing its economic and technological advantage worldwide. In 1980, the Bayh-Dole Act[1] was enacted with the hope to reverse the U.S. recession. The purpose of the Bayh-Dole Act was to "to use the patent system to promote utilization of inventions arising from federally supported research"[2]. After the enactment of the Bayh-Dole Act, the U.S. experienced a substantial rise in university patent activity and commercialization of university technologies. The Bayh-Dole Act "unlocked all the inventions and discoveries that had been made in laboratories throughout the United States with the help of taxpayers' money…[and] helped to reverse America's precipitous slide into industrial irrelevance"[3]. Recently, many countries have enacted or proposed legislation that emulated the U.S. Bayh-Dole Act. More countries will likely look to the Bayh-Dole hoping to reverse the effects of the current economic situation. This paper will look at the economic, social, and scientific effects of Bayh-Dole legislation on the U.S. and other countries in order to determine the requirements for effective application. This paper will concentrate on identifying the elements needed to effectively impact a countries economy through commercialization of university inventions developed with federal funding.

---

[1] *Patent and Trademark Amendments Act of 1980*, Pub. L. No. 96-517, 94 Stat. 3015-28 (codified at 35 U.S.C.A §§ 200-212 (2001)).
[2] 35 U.S.C. § 200.
[3] *Innovation's Golden Goose*, 365 Economist 3, 3 (2002).

Enactment of the Bayh-Dole Act

After World War II, federal research funding shifted from private industry to universities and non-profit organizations emphasizing basic scientific research and development[4]. From 1935-1980 the federal support for academic research and development grew from $138 million to $7.8 billion (1996 dollars)[5]. Despite the increased investment, the number of issued patents resulting from federal funding was in decline[6]. Also, few commercialized products were resulting from federally funded university research[7]. In the mid-1970s, many officials believed that university researchers were not disclosing information and innovations in order to retain academic advantage[8]. Furthermore, of the 28,000 patents owned by the federal government only <5% were licensed, whereas companies were able to license 25-30% patents in which the government did not retain title[9]. The low utilization rate and declining innovation rate was attributed to the government assignment requirements of patents developed with federal funding, ineffective technology transfer of agencies providing federal funding, agencies reluctance to exclusively license to companies, and lack of incentive for university researchers to patent[10,11].

Leading up to the 1980s, the U.S. experienced an economic and scientific recession. The U.S. was experienced high inflation and a decrease in issued patents[12]. The Bayh-Dole Act (P.L. 96-517, Amendments to the Patent and Trademark Act) was enacted to encourage commercialization by permitting non-profit organizations (such as universities) and small

---

[4] Thomas J. Siepmann, *The Global Exportation of the U.S. Bayh-Dole Act*, 30 U. Dayton L. Rev. 209, 214-15.
[5] David C. Mowery et. al., Ivory Tower and Industrial Innovation: University-Industry Technology Transfer before and after the Bayh-Dole Act 24 (2004).
[6] U.S. General Accounting Office, Resources, Community, and Economic Development Division, Pub. No. RCED 98-126, Technology Transfer, Administration of the Bayh-Dole Act by Research Universities 3 (1998).
[7] *Id.*
[8] *Id.*
[9] *Id.*
[10] *Id.*
[11] H.R. Rep. No. 96-1307, pt. 1, at 2 (1980).
[12] Senator Birch Bayh, Bayh-Dole: Don't Turn Back The Clock, Address at the Licensing Executives Society 2006 Annual Meeting (Sept. 12, 2006), *in* 41 les Nouvelles 215, 215 (2006).

businesses to retain title to "subject inventions" made with federal funds and reverse the economic woes being experienced[13]. Under Bayh-Dole, universities may not assign patent rights, but license only[14]. Uniform federal patent policies and guidelines for granting licenses were established under Bayh-Dole[15]. In order to ensure benefit to the U.S. economy, Bayh-Dole requires products manufactured under exclusive licenses to be manufactured substantially in the United States[16]. The Bayh-Dole Act incentivized university patenting by requiring contractors to share royalties with inventors and investment of remaining royalties (after expenses) in university education and research[17].

The Bayh-Dole Act was also passed with provisions "to ensure that the Government obtains sufficient rights in federally supported inventions to meet the needs of the Government and protect the public against nonuse or unreasonable use of inventions"[18]. Under Bayh-Dole, the government has "a nonexclusive, nontransferrable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world"[19]. Also, the government may "march-in" and require license to the government or a third party when action is in the interest health or safety or efforts to commercialize are considered inadequate[20,21].

---

[13] Wendy H. Schacht, The Bayh-Dole Act: Selected Issues in Patent Policy and the Commercialization of Technology 1-2 (CRS Report RL32076) (Feb. 3, 2009).
[14] *Id.*
[15] *Id.*
[16] 35 U.S.C. § 204. "However, in individual cases, the requirement for such an agreement may be waived by the Federal agency under whose funding agreement the invention was made upon a showing by the small business firm, nonprofit organization, or assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible."
[17] 35 U.S.C. § 202(c)(7)(B)-(C).
[18] 35 U.S.C. § 200.
[19] 35 U.S.C. § 202(c)(4).
[20] 35 U.S.C. § 203.
[21] Hugh B. Wellons & Eileen Smith Ewing, Biotechnology and the Law 181 (2007).

The Bayh-Dole Effect in the United States

The expressed purpose of Bayh-Dole Act was "to use the patent system to promote the utilization of inventions arising from federally supported research or development"[22]. Most agree that the Bayh-Dole Act has had a positive impact and meets its expressed goals. Although, there remains a few that argue "the legislation has the potential for unintended and deleterious consequences for the innovation system"[23]. This section will present the effect the Bayh-Dole Act has had on U.S. universities, industry, and economy. This section will also introduce and analyze the validity to the theorized negative effects of Bayh-Dole.

Quantitatively university patent activity significantly rose after the passage of the Bayh-Dole Act. Prior to the Bayh-Dole Act, the number of university patents issued rose by one-third between 1969-1974 and approximately stayed the same between 1974-1979[24]. After enactment, the number of patents issued doubled between 1979-1984, 1984-1989, and 1989-1997[25]. The share of university patents rose from <1% in 1975 to ~2.5% in 1990[26]. Between 1975-1990, the ratio of patenting to research and development funding doubled[27] while overall patenting to research and development funding was declining[28].

After the Bayh-Dole Act was enacted, the rise in university patenting activity was accompanied by a rise in licensing activities. The number of universities with technology

---

[22] P.L. 96-517 at 5.
[23] Sara Boettiger & Alan Bennett, *The Bayh-Dole Act: Implications for Developing Countries*, 46 IDEA 261, 262 (2006).
[24] David Mowery, et. al., *The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh–Dole act of 1980*, 30 Research Policy 99, 103-104 (2001).
[25] *Id.*
[26] *Id.*
[27] Universities developed 7 patents per US$1 billion in constant-dollar R&D spending in 1975 rising to 96 in 1990. *Id.*
[28] Non-University companies and organizations developed 780 patents per US$1 billion in constant-dollar R&D spending in 1975 rising to 429 in 1990. *Id.*

transfer and licensing offices increased from 25 in 1980 to 200 in 1990[29]. Also, licensing revenues from Association of University Technology Manager member universities rose from $222 million in 1991 to $698 million in 1997[30] to $1.25 billion in 2006[31]. 2547 new products have been commercialized from university licenses between 1998-2003[32]. Lastly, since 1980, university licenses have resulted in the formation of 4,081 new companies, creation of ~260,000 jobs, and contribution of ~$40 billion per year to the U.S. economy[33]. Based upon these statistics, it appears clear that the Bayh-Dole Act has met its purpose to encourage commercialization from federally funded research and development.

Some contend that the effects of the Bayh-Dole Act are minimal and are enhanced because of changes in U.S. patent law and a rise in biomedical technologies. In 1980, the Supreme Court interpreted that patentable subject matter was to "include anything under the sun that is made by man"[34]. This decision reaffirmed that life forms were patentable. Also, in 1983 Congress created the Court of Appeals for the Federal Circuit (CAFC), to act as the court of final appeals for patent cases federally and resolve patent rights[35,36]. Furthermore, between 1969-1979 the number of biomedical patents issued to universities rose 123%[37]. Leading up to 1980, university patenting activity was rising[38]. After the enactment of Bayh-Dole, university

---

[29] *Id.*
[30] *Id.*
[31] Ass'n of Univ. Tech. Managers, Fiscal Year 2006 AUTM Licensing Survey Summary (2007).
[32] Chester Moore, *Killing the Bayh-Dole Act's Golden Goose*, 8 Tul. J. Tech. & Intell. Prop. 151, 155-156
[33] *Innovation's Golden Goose*, *supra* note 3.
[34] *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).
[35] United States Court of Appeals for the Federal Circuit, http://www.cafc.uscourts.gov/about.html (last visited Apr. 12, 2010).
[36] Michael Rafferty, *The Bayh–Dole Act and university research and development*, 37 Research Policy 29, 39 (2008).
[37] Mowery, *The growth of patenting and licensing by U.S. universities*, *supra* note 24, at 104.
[38] Rebecca Henderson, Adam B. Jaffe, & Manuel Trajtenberg, *Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting, 1965-1988*, 80 The Review of Economics and Statistics 119, 119-120 (1998).

patenting began to increase more rapidly than overall patenting and domestic patenting[39]. If the Bayh-Dole Act had no effect on university patenting, university patenting would be proportional to the overall and domestic patenting activity. Therefore, university patenting activity could not be solely a result of changing in U.S. patent law and biomedical technologies.

Criticisms of the Bayh-Dole Act appear to be ideologically based, regarding the university's purpose in society and as a research facility. One criticism is that the motive to produce inventions that can be commercialized will shift university research from basic research[40] to applied research[41] and development[42]. According to the NSF, basic research funded and performed by universities without industry or government funding has been greater than both applied research and development since the late 1960s[43]. Rafferty states: "[i]f the Bayh–Dole Act of 1980 caused a switch away from basic R&D activities then one would expect the trend rate for basic R&D to decline after 1981 and the trend rates for applied and development R&D to increase. This clearly did not happen."[44] Furthermore, federal agency funding of university projects has not displayed a movement away from basic research[45]. The percent of overall funding from federal agencies for research performed at universities averaged 68% of

---

[39] *Id.*

[40] The National Science Foundation (NSF) definition of "basic research" states: "The objective of basic research is to gain more comprehensive knowledge or understanding of the subject under study without specific applications in mind. In industry, basic research is defined as research that advances scientific knowledge but does not have specific immediate commercial objectives, although it may be performed in fields of present or potential commercial interest." National Science Foundation, Division of Science Resources Statistics, *National Patterns of Research Development Resources: 2003 Special Report* 7 (2005).

[41] The NSF definition of "applied research" states: "The objective of applied research is to gain the knowledge or understanding to meet a specific, recognized need. In industry, applied research includes investigations to discover new scientific knowledge that has specific commercial objectives with respect to products, processes, or services." *Id.*

[42] The NSF definition of "development" states: "Development is the systematic use of the knowledge or understanding gained from research directed toward the production of useful materials, devices, systems, or methods, including the design and development of prototypes and processes." *Id.*

[43] Rafferty, *The Bayh–Dole Act and university research and development*, *supra* note 36, at 32.

[44] *Id.*

[45] *Id.*

basic research, 53% of applied research, and 62% of development from 1953-1997[46]. Lastly, as of 2007 greater than 94% of university research and development financing comes from the government[47]. While the Bayh-Dole Act may incentivize universities to pursue applied research and development that result in patents and revenues from patent licenses, it does not appear that Bayh-Dole is having an effect on university funding.

Critics also argue that the Bayh-Dole Act limits "open science" by reducing or delaying disclosure[48] . Any program that incentivizes patenting cannot limit "open science". The *quid pro quo* for being granted exclusive rights under a patent is that the science and knowledge behind an invention is dedicated to the public through publication. Patent law is intended to prevent all innovation from being held as trade secret. Instead, patent law requires disclosure for the benefit of society in exchange for exclusive rights. It is also contended that the limitation of "open science" occurs by delayed publications or restriction requirements under license agreements[49]. This limitation is only asserted based upon anecdotal evidence. A survey of 112 licensing executives that regularly enter license agreements with universities showed that only 27% of license agreements had special clauses that allow the deletion of information from publication, 44% include delay of publication clauses, and the average delay was 3.9 months with 12 months being the longest delay[50]. Unfortunately, information is scarce regarding the impact of Bayh-Dole on "open science". Therefore, the impact cannot be precisely determined,

---

[46] *Id.*
[47] nsf.gov - S&E Indicators 2010 - Chapter 4. Research and Development: National Trends and International Linkages - International R&D Comparisons - US National Science Foundation (NSF), *available at* http://www.nsf.gov/statistics/seind10/c4/c4s5.htm#s6.
[48] Boettiger, *The Bayh-Dole Act: Implications for Developing Countries*, *supra* note 23, at 267.
[49] *Id.*
[50] Jerry G. Thursby and Marie C. Thursby, *University Licensing Under Bayh-Dole: What are the Issues and Evidence?* 6, May 2003, available at http://opensource.mit.edu/papers/Thursby.pdf.

but it appears from the *Thursby* surveys that the effect of Bayh-Dole on "open science" is minimal[51].

Assertions that the U.S. government and universities restrict access to basic research are also made by critics. *Boettiger & Bennett* state:

> North-South partnerships are a key element in developing countries' access to technology. The North's concentrated ownership and control of technologies necessary for research in agriculture and health creates the potential for the needs of the poor and underserved to remain unmet by technological advances… In their patent portfolios, U.S. universities and non-profit institutions hold a valuable resource to which developing country access may be increasingly limited. While the U.S. public sector owns roughly 2.5% of patents across all technology fields, in agriculture the story is quite different; almost a quarter of patents are owned by universities and non-profit research institutions. In health, too, patents central to developing country needs are held by universities.[52]

This assertion is a direct juxtaposition to the critique that basic research will be neglected. How can U.S. universities limit access to basic research that is not occurring? Furthermore, this statement implies that the North uses patents and other intellectual property rights to subjugate the developing South[53]. This critique fails to consider that these problems will persist until "the South acquires the capacity and capability to assert its own interests, agendas, and rights"[54]. It also furthers the myth that Southern countries are incapable of innovation and establishing intellectual property protection systems without the assistance of the North. Development of infrastructure, public health systems, and technological sophistication focusing on a countries individual needs and interests is likely the best solution for Southern countries to become self sufficient[55].

---

[51] *Id.*
[52] Boettiger, *The Bayh-Dole Act: Implications for Developing Countries*, *supra* note 23, at 262-63.
[53] Stanley P. Kowalski, *Intellectual property, medicine and health: Current debates*, 16 J. Com. Biotechnology 191, 193 (2010) (book review).
[54] *Id.*
[55] *Id.*

Finally, the Bayh-Dole Act has been claimed to create a "tragedy of the anticommons" effect[56]. "The tragedy of the anticommons refers to the more complex obstacles that arise when a user needs access to multiple patented inputs to create a single useful product."[57] The "tragedy of the anticommons" effect has become a concern to universities because of the CAFC's holding in *Madey v. Duke University*[58]. *Madey* held that the experimental-use defense "is is very narrow and limited to actions performed for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry"[59]. The exemption does not apply to patent infringement "so long as the act is in furtherance of the alleged infringer's legitimate business"[60]. The CAFC further held that research projects "further the institution's legitimate business objectives, including educating and enlightening students and faculty participating in these projects… to increase the status of the institution and lure lucrative research grants, students and faculty."[61] "Moreover, the profit or non-profit status of the user is not determinative."[62] Therefore, the risk of patent infringement restricts university research. Despite the far reaching implications of *Madey*, it appears that it is an isolated case. Also, *Madey* only applies to private universities because state universities have sovereign immunity under the Eleventh Amendment[63]. The anticommons theory is very controversial and evidence of the anticommons effect is limited[64].

Emulation of the Bayh-Dole Act Internationally

"One size fits all" legislation has proven to be ineffective internationally. Each country has its own social, economic, and legal nuances that need to be considered for legislation to be

---

[56] Moore, *Killing the Bayh-Dole Act's Golden Goose*, *supra* note 32, at 154-155.
[57] Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 Science 698, 699 (1998).
[58] *Madey v. Duke Univ.*, 307 F.3d 1351 (Fed. Cir. 2002).
[59] *Id.* at 1362.
[60] *Id.*
[61] *Id.*
[62] *Id.*
[63] U.S. Const. amend. XI.
[64] Moore, *Killing the Bayh-Dole Act's Golden Goose*, *supra* note 32, at 155.

effective in meeting its purpose. This section is a review of legislation emulating Bayh-Dole internationally and the corresponding effect.

Japan

In the late 1990s, Japan was facing economic woes. Japan's Ministry of Economy, Trade, and Industry (METI), in light of the effectiveness of the U.S. Bayh-Dole Act, determined that intellectual property legislation was essential to economic recovery[65]. The Japanese government established the Commission for Intellectual Property Rights in the 21st Century. In 1997, the Commission published Toward the Era of Intellectual Property Creation: Challenges for Breakthrough. The report concluded that: (1) Japanese universities were not being aggressive in their efforts to exploit intellectual property rights and (2) there were major barriers inhibiting transfer of university technologies to the private sector for commercialization. The Commission suggested that technology transfer offices be setup in order to take advantage of new technologies, allow researchers to have partial ownership in inventions, and for the government to incentivize University-Industry joint research[66]. In response to the Commission's findings, Japan enacted the Technology Transfer Promotion Law in 1998[67], the Industrial Revitalization Special Law in 1999[68] (known as the "Japanese Bayh-Dole Act") and the National University Legal Entity Law 2003[69,70].

---

[65] Toshiko Takenaka, *Technology Licensing and University Research in Japan*, Int'l J. Intell. Prop. 27, 27 (2005).
[66] Commission on Intellectual Property Rights in the Twenty First Century, Toward the Era of Intellectual Property Creation: Challenges for Breaktrough 20-24 (1997).
[67] Daigakutō ni okeru gijutsu ni kansuru kenkyū seika no minkan jigyōsha he no iten no sokushin ni kansuru hōritsu [The Law for Promoting University-Industry Technology Transfer], Law No. 52 of 1998.
[68] Sangyō Katsuryoku Saisei Tokubetsu Sochihō [Industrial Revitalization Law], Law No. 131of 1999, ch. 3, arts. 30–33.
[69] Kokuritsu daigaku hōjinhō [National University Legal Entity Law], Law No. 112 of 2003.
[70] Toshiko Takenaka, *Success or Failure? Japan's National Strategy on Intellectual Property and Evaluation of its Impact from the Comparative Law Perspective*, Wash. U. Global Stud. L. Rev. 379, 384-386 (2009).

Intellectual property ownership and transfer rights in Japanese universities[71] is governed by the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) guideline notification. Prior to the above enactments, invention ownership and transfer rights was determined by the source of funding:

- If the invention arose under donation or the professor's standard research allowance, the inventor may retain ownership with no transfer requirements[72].
- If the invention arose under a "Commissioned" or "Joint Research" contract with a private company, or MEXT grant, the invention is a "National Invention" owned by the nation through the university[73], unless the company negotiates to co-own the invention or receive preferential license with the university[74,75].
- If the invention arose under government project specific funding or from research at a special research facility, the invention is a "National Invention" owned exclusively by the nation[76,77].

The "Japanese Bayh-Dole Act" granted contractors of Commissioned or Joint Research projects the right to claim resulting inventions[78]. Although, the Japanese Bayh-Dole Act only applied to private universities and not Japanese National Universities[79] (public universities that "account[s]

---

[71] Robert Kneller, *University-Industry Cooperation and Technology Transfer in Japan Compared with the United States: Another Reason for Japan's Economic Malaise?*, 24 U. Pa. J. Int'l Econ. L. 329, 357 (2003).
[72] *Id.* at 381.
[73] *Id.* at 356.
[74] *Id.* at 381.
[75] "[T]he Author knows of no case of a Japanese university competing with one of its patent co-owners, the possibility of such competition is of concern to some companies contemplating Commissioned or Joint Research with universities as well as venture funds considering investing in such companies." *Id.* at 362-364.
[76] *Id* at 381-382.
[77] The Japan Science and Technology Corporation (a public entity charted by the Science and Technology Agency is responsible for patenting and licensing "National Inventions" arising under government project specific funding or from research at a special research facility
[78] *Id.* at 385
[79] Takenaka, *Success or Failure?*, *supra* note 70, at 385.

for at least 75% of university R&D and include Japan's most prestigious universities"[80]) because National Universities were not considered a separate legal entity from Japan[81]. The National University Legal Entity Law designated National Universities as independent legal entities and therefore can claim ownership to resulting inventions[82]. The effect of these two acts on the commercialization of university patents was only realized because of the prior enactment Law for Promoting University-Industry Technology Transfer established university Technology Licensing Offices, facilitating the transfer of university invention by providing financial incentives for approved Technology Licensing Offices[83].

The coverage of the Japanese Bayh-Dole Act is much broader than its U.S. counter-part. The Japanese Act does not only apply to patents. It also applies to utility models, designs, copyrights for computer programs and databases, and semiconductor chip layout[84]. In order to retain ownership of patents arising from government contracted research and development universities and research institutions must: (1) report inventions to the government immediately after disclosure from researchers, (2) grant the government a royalty free license, and (3) grant a license to a third party if no reasonable attempt is made to commercialize the patent. These requirements are very similar to the U.S. Bay-Dole disclosure requirement[85], granting a nonexclusive royalty free license to the U.S. government[86], and march-in rights[87]. The Japanese government does retain a right "to choose to refuse a transfer of patent and other rights" from

---

[80] *Id.* at 357
[81] Takenaka, *Success or Failure?*, *supra* note 70, at 385.
[82] *Id.*
[83] Law for Promoting University-Industry Technology Transfer allowed METI and MEXT to develop guidelines and standards for Technology Licensing Offices to encourage university technology transfer to industry. Although any university was allowed to create a Technology Licensing Offices, MEXT-METI approved Technology Licensing Offices are entitled to certain advantages, such as grants, METI guaranteed Technology Licensing Office debts facilitating bank loans, discounted fees for patents, etc. Takenaka, *Technology Licensing*, *supra* note 65, at 28.
[84] *Id.* at 27-28.
[85] 35 U.S.C. § 202(c)(1).
[86] 35 U.S.C. § 202(c)(5).
[87] 35 U.S.C. § 203.

contracting parties. Therefore, the Japanese government appears to be able to refuse intellectual property rights at its discretion[88]. This is much broader than the U.S. march-in rights, which requires "reasonability" or failure to meet federal regulations or other statutory requirements to allow the federal agency to right to march-in[89].

The purpose of the Japanese Act is to "maximize business resources in Japan for the recovery of Japan's economy"[90] which is much broader than the purpose of the U.S. Bayh-Dole Act[91]. The difference in purpose creates some essential differences between the U.S. and Japanese Acts. The Japanese Act does not restrict assignment of rights to the university or organization "which has as one of its primary functions the management of inventions" as the U.S. Bayh-Dole Act does[92]. Also, the Japanese Act has no stated preferences for Japanese companies[93,94]. Finally, the Japanese Act has no business size preference as stated in the U.S. Bayh-Dole Act[95,96].

---

[88] Takenaka, *Technology Licensing*, *supra* note 65, at 28.
[89] 35 U.S.C. § 203
[90] Takenaka, *Technology Licensing*, *supra* note 65, at 28.
[91] The purpose of the U.S. Bayh-Dole Act is to promote participation of small business in federally supported research and development. "It is the policy and objective of the Congress to use the patent system to promote the utilization of inventions arising from federally supported research or development; to encourage maximum participation of small business firms in federally supported research and development efforts; to promote collaboration between commercial concerns and nonprofit organizations, including universities; to ensure that inventions made by nonprofit organizations and small business firms are used in a manner to promote free competition and enterprise without unduly encumbering future research and discovery; to promote the commercialization and public availability of inventions made in the United States by United States industry and labor; to ensure that the Government obtains sufficient rights in federally supported inventions to meet the needs of the Government and protect the public against nonuse or unreasonable use of inventions; and to minimize the costs of administering policies in this area." 35 U.S.C. § 200.
[92] 35 U.S.C. § 202(c)(7)(B).
[93] METI released a new model contract for government agencies to use when funding research under the Japanese Bayh-Dole Act. This new model contract has a Japanese manufacture preference clause. This clause requires the commissioning ministry approval of all technology transfers to third parties. However, no approval criteria has been set. Kneller, *University-Industry Cooperation*, *supra* note 71, at 426.
[94] 35 U.S.C. § 202(c)(7)(C).
[95] Takenaka, *Technology Licensing*, *supra* note 65, at 28.
[96] The U.S. Bayh-Dole Act has been extended to include all large federal to retain title to and profit from the inventions created under federally funded research projects. Exec. Order No. 12591, 52 Fed. Reg. 13,414 (Apr. 10, 1987).

Japan's commitment to commercialization of federally funded university inventions has had a positive effect on Japan's universities and industry. Technology Licensing Offices grew from 4 to 41 (representing nearly all universities) between 1998-2005[97]. University-industry cooperative projects increased from ~1,500 to ~6,500 between 1995-2003[98]. University based start-ups rose from 92 to 1,099 between 1995-2005[99]. Between 2002-2005, the number of patents issued has increased 3.6-fold and license revenues have increased 4.3 fold[100,101,102]. Technology transfer officers have established the professional society University Technology Transfer Association (UNITT)[103]. UNITT is similar to the Association of University Technology Managers (AUTM) in the U.S. UNITT was established in 2004 and currently 68 universities are members[104].

South Korea

South Korea (hereinafter "Korea") has evolved to from one of the least developed countries in the world in 1960 with a gross domestic product of ~$156 per capita[105]. Today, Korea is one of the leading industrial countries in the world with a per capita gross domestic

---

[97] John Walsh et. al., *Promoting University-Industry Linkages in Japan: Faculty Responses to a Changing Policy Environment*, 26 Prometheus 39, 41 (2008).
[98] *Id.* at 42.
[99] *Id.* at 42, 44. These cannot only be attributed to the Technology Transfer Promotion Law, the "Japanese Bayh-Dole Act"), and the National University Legal Entity Law because METI established subsidies under the *Hiranuma Plan* in 2001 with the expressed goal to setup 1,000 university startups within 3 years. *Id.* at 41-42.
[100] Takenaka, *Success or Failure?*, *supra* note 70, at 386 n.35.
[101] A study of patent portfolios of the University of Tsukuba, Hiroshima University, and Tohoku University (all National Universities) shows patents belonging to the university or associated Technology Licensing Offices increased from 8-40, 30-143, and 27-324, respectively, between 2004-2006. This displays the increase of patenting activity seen from National Universities after they became individual legal entities when the National University Legal Entity Law was enacted in 2004. Daisuke Kanama & Kumi Okuwada, *A Study on University Patent Portfolios (2): The Impact of Intellectual Property Related Policies and the Change into Corporation of National University*, *available at* http://www.nistep.go.jp/achiev/abs/eng/mat154e/pdf/mat154ae.pdf.
[102] Translated reports of university patent and licensing statistics were unavailable for further analysis.
[103] University Technology Transfer Association, http://unitt.jp/en.
[104] *Id.*
[105] GDP (per capita) (1960) by country, http://www.nationmaster.com/graph/eco_gdp_percap-economy-gdp-per-capita&date=1960.

product greater than $18,000[106]. Korea's rapid industrial and technological growth has been attributed to the enactment of the Korean Patent Law in 1961[107], the governments commitment to invest in research and development, domestic policy shift from a technological-push to market pull, and ability rapidly adapt to commercialize technologies resulting from research and development[108].

In 1972 (8 years prior to the Bayh-Dole Act), the Research and Development Promotion Act was enacted enabling contractors to hold title to inventions developed with government funding[109]. However, national and public universities[110] held very few patents because inventions made in the service of their responsibilities to the university were transferred to the government[111]. Korea's ability to turn research and development into commercial products was limited until the reforms between 1997-2001. Similar to the recession experienced by the U.S. in the 1970s and Japan in the late 1990s, Korea experienced a drop in their gross national product per capita from $11,467 to $7,462 between 1995[112]-1998[113]. Recognizing the potential impact of technology commercialization, the Korean science and technology policy shifted from technology development to commercialization[114]. The Korean government enacted the Special Measure Act for Science and Technology Innovation, the Special Measure Act for Promotion of Venture Businesses, and Technology Transfer Promotion Act and revised its Patent Law to allow

---

[106] GDP (per capita) (2006) by country, http://www.nationmaster.com/graph/eco_gdp_percap-economy-gdp-per-capita.
[107] Joseph Wong, *From learning to creating: biotechnology and the postindustrial developmental state in Korea*, 4 Journal of East Asian Studies 491 (2004).
[108] Jong-Bok Park, *Strategies for Improving Technology Commercialization in the Korean Public R&D Sector*, 13 KIET Industrial Economic Review 27, 27-28 (2008).
[109] Jong-Bok Park, *Public-to-private Technology Transfer System in Korea: the Case of The Regional Consortium of Technology Licensing Offices* 3, *available at* http://www.iamot.org/conference/index.php/ocs/4/paper/view/949/378.
[110] National and public universities have the highest prestige in Korea. *Id.*
[111] *Id.*
[112] GDP (per capita) (1995) by country, http://www.nationmaster.com/graph/eco_gdp_percap-economy-gdp-per-capita&date=1995.
[113] GDP (per capita) (1998) by country http://www.nationmaster.com/graph/eco_gdp_percap-economy-gdp-per-capita&date=1998.
[114] Park, *Strategies for Improving Technology Commercialization*, *supra* note 108, at 28.

universities to hold title to patents developed by faculty[115]. These four legislative acts were all enacted to facilitate technology transfer and commercialization[116]. The Special Measure Act for Science and Technology Innovation "[r]equired the government to develop adequate supporting measures for science and technology innovation, putting the emphasis on technology diffusion and deployment"[117]. The Special Measure Act for Promotion of Venture Businesses enabled university researchers to form start-up businesses while retaining their employment at the university[118]. These two acts facilitated the direct injection of publically funded inventions to industry. The Technology Transfer Promotion Act installed Technology Transfer Offices in each university and required at least one staff member to be dedicated directly to technology transfer[119]. This act further facilitated the commercialization of university inventions by enabling easier transfer to commercial entities with the capability to commercialize the invention.

Korea's emphasis on university technology transfer has had a positive effect. In 2000, no Korean universities had a Technology Licensing Office[120]. By 2009, 90 Technology Licensing Offices had been established[121]. University patents applications and patents grew from 1,832 to 7,326 and from 926 to 4052, respectively, between 2003-2007[122]. Greater than 75% of universities applied for patents between 2003-2007[123]. Technology transfer contracts increased

---

[115] Park, *Public-to-private Technology Transfer*, *supra* note 109, at 4.
[116] *Id.*
[117] *Id.*
[118] *Id.*
[119] *Id.*
[120] Rhee Jongtae, *Towards the Establishment of an IP Network for Technology Transfer Organizations in the Asian Region ~ Asia AUTM Session ~*, Report on the International Patent Licensing Seminar 2008 262-263 (2008), *available at* http://www.ryutu.inpit.go.jp/seminar_a/2009/pdf/D4_e.pdf.
[121] Representing >64% of all universities in Korea. *Id.*
[122] *Id.*
[123] *Id.*

from 210 in 2003 to 951 in 2007 with greater than 50% of universities agreeing to contracts[124]. Royalties from university licensing have increased from $1.97 million to $16.4 million between 2003-2007[125]. Royalties received per input cost has grown 500% from 2003-2007[126]. Also, the Korea Association of University Technology Transfer Management (KAUTM), a professional society for Korean university technology managers, was established in 2002[127].

China

Intellectual property law in China is relatively new. China's first patent law was adopted in 1984[128]. Prior to 1994, there was no established law or regulation regarding the ownership of inventions made with federal funding, but universities were considered de facto owners[129]. In 1994 the National Commission of Science and Technology established regulations in *Measures for Intellectual Property Rights Made under the Governmental Funding of the National High Technology Program*[130]. It stipulated that unless otherwise identified in a government contracts the university will be the owner of intellectual property created with government funds[131]. In 2002, the Ministry of Science and Technology and the Ministry of Finance issued *Measures for Intellectual Property Made under Government Funding* ("Chinese Bayh-Dole Act")[132]. The "Chinese Bayh-Dole Act" entitled universities to all intellectual property developed with federal funding with the government retaining a non-exclusive, royalty free license, established march-in

---

[124] *Id.*
[125] *Id.*
[126] *Id.*
[127] *Id.*
[128] Gregory D. Graff, *Echoes of Bayh-Dole? A Survey of IP and Technology Transfer Policies in Emerging and Developing Economies*, *in* Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices 169, 175 (2007).
[129] Hua Guo, *IP Management at Chinese Universities*, *in* Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices 1673, 1675 (2007).
[130] *Id.*
[131] *Id.*
[132] *Id.*

rights, and required the university to give preference for the inventor when commercializing[133]. The Commission on Science, Technology, and Industry for National Defense also issued similar regulations related to defense contracts in *Measures for Intellectual Property Rights Made under Governmental Funding of Defense Technology Projects*[134]. These regulations create the presumption that universities own intellectual property funded by the Chinese government. Although, there still remains no legislation that stipulate the entitlements set in these regulations[135].

University patenting activity in China has responded to the enactment of these "Bayh-Dole like" regulations, although the regulations have been less successful in creating commercial products from inventions created with government funding. Patent applications filled by Chinese universities rose from 988 in 1999[136] to ~13,500 in 2004[137]. The total number of patents granted to Chinese universities rose from 1,548 to 5,505 between 2000-2004[138]. A rise in patent licenses and/or commercialization corresponding to the increase in patent activity has not occurred[139]. Many attribute the university culture and policies, ineffective technology transfer, and limited industrial capability as reasons for the low commercialization rate[140]. Chinese academics and university administrators have equated patents and patent applications to scholarly publication, limiting the number of patents with commercial applicability[141]. This scholarly attribute given to patents has affected university technology transfer offices by gearing

---

[133] *Id.* at 1675-1676.
[134] *Id.*
[135] *Id.*
[136] Graff, *Echoes of Bayh-Dole?*, *supra* note 128, at 176.
[137] Guo, *IP Management*, *supra* note 129, at 1676.
[138] Wang Haiyan & Zhou Yuan, *The Evolving Role of Universities in the Chinese National Innovation System* 22, *available at* http://www.fpi.lu.se/_media/en/research/UniDev_DP_China.pdf.
[139] Guo, *IP Management*, *supra* note 129, at 1677.
[140] *Id.* at 1676-1681.
[141] Patents and patent applications are criteria for promotion. Also, the Ministry of Education has begun to rank universities based upon patenting activity. Graff, *Echoes of Bayh-Dole?*, *supra* note 128, at 176.

the offices towards filing patents rather than licensing technology to industry[142]. Furthermore, the application of new technologies is limited by the Chinese industry's limited infrastructure to commercialize and develop new technologies[143].

Other Countries Emulating the Bayh-Dole Act

Many countries world-wide have enacted or have proposed legislation that emulates the Bayh-Dole Act. These countries include Austria, Brazil, Belgium, Denmark, Finland, Germany, India, Malaysia, Norway, Philippines, South Africa, and Taiwan[144]. Some countries, such as Denmark and Germany, are enacting legislation almost identical to the U.S. Bayh-Dole[145]. Other countries, such as Belgium, are emulating Bayh-Dole by government research regulations similar to China's approach[146]. Germany and Belgium also have set up university technology transfer systems emulating Japan and Korea's to facilitate commercialization[147].

---

[142] *Id.*
[143] *Id.*
[144] These countries will only be identified but not analyzed because of the lack of sufficient data showing the effect of enacting "Bayh-Dole like" legislation on patenting, technology transfer, licensing, and/or commercialization. Addressing each country was considered, but due to length the countries were omitted. Post-Bayh-Dole emulation is available for some countries, but this data is inconsistent in regard to this papers approach. Assessment of the economic, patenting, patent law, and university conditions before and after the enactment of "Bayh-Dole like" legislation is necessary to determine the requirements for effective enactment. Other scholarly publications, government documents, etc. address the lack of data availability such as: Aldo Geunaa & Lionel J.J. Nesta, *University patenting and its effects on academic research: The emerging European evidence*, 35 Research Policy 790 (2006), David C. Mowery et. al., Ivory Tower and Industrial Innovation: University-Industry Technology Transfer before and after the Bayh-Dole Act 24 (2004), etc.
[145] Germany's amendment to the German Employed Inventor's Act 2002 allows universities to lay claim to inventions created by its employees with government funding on its campus and requires universities to share 30% of the profits stemming from the commercialization of their discovery. Denmark has also amended its patent laws to grant universities right to inventions made by researchers with federal funding and have requirements for royalty sharing. Siepmann, *The Global Exportation*, *supra* note 4, at 222.
[146] Organisation for Economic Co-operation and Development, Turning Science Into Business: Patenting And Licensing At Public Research Organisations 25 (2003).
[147] Siepmann, *The Global Exportation*, *supra* note 4, at 222.

Requirements for the Effective Application of Bayh-Dole

The U.S. embarked on this experiment called the Bayh-Dole Act in order to climb out of the economic and technological recession of the 1970s. Since its enactment, Bayh-Dole has had a huge effect on the technological and economic advantage the U.S. has retained over the last 3 decades. The Bayh-Dole Act has bridged the gap between government funded research and industrial application allowing the U.S. to become world leader in areas such as computer and biomedical technology. More recently, China, Japan, and Korea looked to the Bayh-Dole Act hoping to counteract the effects of the Asian financial market crisis. In the 30th year of Bayh-Dole, the world is experiencing an economic crisis very similar to what the U.S. was facing in the 1970s and Asian countries were experiencing in the late 1990s. In order to counteract the effect of the current economic situation, countries are looking at emulating Bayh-Dole and others are likely to follow.

Successful application of Bayh-Dole requires legal and social incentives at the government and university level. Analyzing the economic, legal, educational, and industrial conditions of the U.S., Japan, Korea, and Japan before and after enacting Bayh-Dole, the following elements necessary for effective application of Bayh-Dole were identified:

Government:

1. **Stable and Transparent Patent Law with Effective Enforcement:** The U.S., Japan, and Korea all had strong and effective intellectual property law at the time Bayh-Dole was enacted. The U.S. Patent and Trademark Office, the Japanese Patent Office, and the Korean Intellectual Property Office are 3 of the 5 largest patent offices in the world. Japan, Korea, and the U.S. have established and long standing patent laws with Japanese

patent law established in 1868[148], Korean patent law established in 1908[149], and U.S. patent law established in 1790[150]. China's patent law is relatively new, being established in 1984[151]. Also, according to the International Property Rights Index 2010 report, the intellectual property rights ranking for the U.S. was 1st, Japan was 4th, Korea was 23rd, and China was 63rd[152]. Stable and transparent intellectual property law with effective enforcement is necessary to establish incentive to patent and license and for society to understand and respect patents rights. Furthermore, the law needs to clearly identify the owner of patents developed with federal money (through federal law, employment law, or regulation). Failure to identify the owner and who may benefit from a patent does not provide incentive to commercialize. Companies are less likely to invest the funds necessary to commercialize a product if return on investment is less likely. The exclusionary rights granted to patent holders reduces the inherent risk involved with investment. Legislation granting ownership to federally funded inventions to the university and requiring universities to share royalties with the inventor appears to be the most effective system to entice university researchers to patent. The university becomes the best entity through which university inventions can be commercialized when there is an effective technology transfer office acting on behalf of the university[153]. The government proved to be ineffective at technology transfer in every country reviewed[154].

---

[148] History of the Japanese Patent System, *available at* http://www.patentlens.net/daisy/patentlens/2648.html.
[149] Robert Goldscheider & Alan H. Gordon, Licensing best practices: strategic, territorial, and technology issues 48 (2006).
[150] Happy Anniversary of the first American Patent Act, *available at* http://inventors.about.com/library/weekly/aa073100a.htm
[151] Guo, *IP Management*, *supra* note 129, at 1673.
[152] Victoria Strokova et. al., International Property Rights Index: 2010 Report 35 (2010).
[153] China is an example where vesting title in the university essentially serves no purpose, since university technology transfer offices fail to advertise or attract industry to license university patents.
[154] The rise in Bayh-Dole emulating legislation suggests that governments agree with this statement.

2. **Government Commitment to Technical and Scientific Education, Research, and Related Infrastructure:** A government commitment to technical and scientific education and research requires abundant federal funding to allow university research to be independent of industrial and commercial influence. Abundant federal funding allows the employment of full-time professors and investigators that are dedicated to academic research (rather than applied research). Federal funding also allows this academic work-force to perform basic research enabling growth in new areas of science and technology. Lastly, abundant federal funding provides the equity necessary to form start-ups from university innovations. The U.S. government provides greater than 94% of the research and development funding in universities[155]. In 2007, Japan funded ~97%, Korea funded 85%, and China funded 65% (the lowest of the top 10 research and development performing countries) of overall university research and development[156]. The high investment of university research and development allowed the U.S. to enter into areas such as biotechnology, computers, semiconductors, etc. to allow technological hot beds to develop, such as Silicon Valley. Also, in 1999, Korea funded ~89% of university research. As mentioned earlier, it was around this time that funding was funneled towards technology transfer. Korea's shift to a market pull strategy for innovation and commitment to technology transfer enabled the economy to recover in a just a few years[157]. The high funding of universities also allows the U.S. to have a large, prestigious university system with a high population of full time autonomous faculty researchers. Lastly, as mentioned above, without the industry's influence, there is no confusion of

---

[155] nsf.gov, *supra* note 47.
[156] The gross expenditure for university research and development in the U.S. was ~$49 billion, Japan was ~$18.6 billion, China was ~$8.7 billion, and Korea was $~4.5 billion. *Id.*
[157] Park, *Strategies for Improving Technology Commercialization*, *supra* note 108, at 28.

ownership that will reduce the incentive to patent. The patenting activity of Chinese universities continues to grow, despite the elevated funding by industry without universities retaining ownership rights and royalty sharing[158], is likely because faculty patents are considered equivalent to publication. In this case, motivation to patent is related to academic prestige and job promotion rather than by prospective financial gain[159].

3. **Limited Government Influence on Industry and Universities:** Invoking march-in rights or compulsory licensing often, randomly, or without reason reduces the value of a patented technology. The risk of losing exclusionary rights reduces the incentive to invest in commercializing a patent. From countries reviewed, it appeared that every Bayh-Dole emulation had a government option to license or take title to a patent developed with government funding for public safety or health or when the holder is not reasonably attempting to commercialize. Although some disagree, limited application of march-in rights and compulsory licenses serves the public good by attracting investment to research and development. Also, the government should essentially allow university research to be autonomous, so a multitude of different research projects can be pursued. The U.S. government's *laize faire* approach to university research allowed research to advance into many different areas. Furthermore, the government should not try to direct industry. Market demand should drive industry, so demand drives commercialization. Korea's technology push domestic policy reduced its ability to adapt by forcing

[158] Haiyan, *The Evolving Role of Universities*, *supra* note 138.
[159] Graff, *Echoes of Bayh-Dole?*, *supra* note 128, at 176.

university research and development away from market forces[160]. The U.S. prior to Bayh-Dole had a similar experience of government interference[161]. The U.S. government's failure to grant exclusive licenses to government funded inventions reduced the value of publicly developed inventions and weakening the incentive for industry to invest in commercialization[162]. It was not until this limitation was removed with the Bayh-Dole Act before university patents could be transferred to industry for commercialization[163]. Lastly, universities should be a separate legal entity from the government. As was experienced in Japan and Korea, there were ownership issues involved with faculty of public universities. Also, universities seem to operate best when they pursue their own policies and initiatives rather than the governments, evidenced by Korean and U.S. universities.

University:

1. **Clear and Agreed Upon Employment Contracts with Formal Patent Policies and Guidelines:** As stated above, ownership of patents developed with government funding should vest in the university. This can be accomplished by legislation and/or employment contract. The employment contract should also define ownership of patents developed in any other capacity (such as industry-university research collaborations, etc.). These stipulations will remove any conflict of ownership situations. The contract should also contain royalty or profit sharing provisions, so there remains an incentive to

---

[160] Park, *Strategies for Improving Technology Commercialization*, *supra* note 108, at 28.
[161] Susan K. Finston, *Technology Transfer Snapshots from Middle-Income Countries: Creating Socio-Economic Benefits through Innovation*, *in* Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices 197, 199 (2007).
[162] *Id.*
[163] *Id.*

invent. This can also be accomplished by legislation. The employment policies should contain patent disclosure guidelines to promote communications between the inventor, university, and technology transfer office.

2. **Effective and Efficient Technology Transfer Office:** Establishing a technology transfer office with the proper education and experience is essential to the commercialization of university patents. The technology transfer office should not only be concerned with licensing technology, they should also manage the intellectual property within the university, including keeping track of licenses and other agreements, educating faculty, and establishing uniform policies for the university to avoid intellectual property issues. The technology transfer office also should work with both the inventor and industry to best commercialize university inventions. The technology transfer office appears to be the most essential element of commercializing inventions developed with federal money. It also appears to be the most overlooked aspect of Bayh-Dole effectiveness at first glance because it is mysteriously absent from U.S. statute. It is likely that most consider the university's retention of title to federally funded inventions to be the most vital privilege granted by the Bayh-Dole Act because of the rise in patenting that corresponds with enactment. However, this privilege only removes the limited access created by the government's ineffective technology transfer. If universities were equally as incapable of technology transfer, the Bayh-Dole Act would have had no effect. For example, China saw no increase in commercialization after regulations were issued that allowed universities to retain right in inventions developed

with government funding[164]. The Chinese government and universities were equally ineffective at technology transfer. Prior to the enactment of Bayh-Dole in the U.S., many universities had already established technology transfer offices[165]. When Bayh-Dole released government held patents, the technology transfer offices created the corresponding licensing effect. The effect of technology transfer offices and Bayh-Dole emulation can be evidenced in both Japan and Korea. In Japan, technology transfer offices were established prior enactment of Bayh-Dole, while in Korea technology transfer offices were established after enactment. When the Japanese Bayh-Dole Act was enacted, a rise in patent activity and licensing occurred immediately[166]. While the effect was not realized in Korea until after the enactment of the Technology Transfer Promotion Act[167,168]. The Bayh-Dole Act appears to have its greatest effect when technology transfer is available. The Bayh-Dole Act created an incentive for university inventors to patent and technology transfer offices enabled the patents to be commercialized.

Conclusion

The U.S. Bayh-Dole Act has inspired a number of countries to enact similar legislature, unlocking access to university patents, with the hope of experiencing the benefits the U.S. has. While most countries have experienced a positive effect, some were unable to. Granting universities title to patents developed with government funding in almost every country has boosted university patent activity. The Bayh-Dole Act awakens academic innovation by

---

[164] Guo, *IP Management*, *supra* note 129, at 1677.
[165] Mowery, *The growth of patenting and licensing by U.S. universities*, *supra* note 24.
[166] Takenaka, *Success or Failure?*, *supra* note 70, at 386 n.35.
[167] Park, *Public-to-private Technology Transfer*, *supra* note 109, at 4.
[168] Rhee Jongtae, *Towards the Establishment of an IP Network for Technology Transfer Organizations in the Asian Region ~ Asia AUTM Session ~*, Report on the International Patent Licensing Seminar 2008 262-263 (2008), *available at* http://www.ryutu.inpit.go.jp/seminar_a/2009/pdf/D4_e.pdf.

allowing the incentive of patenting to be realized by faculty. Although, this increase in university patent activity does not always translate into economic benefits. The economic impacts are only realized when effective technology transfer offices are in place to facilitated the commercialization of university patents. The Bayh-Dole effect is not realized until technology transfer offices are established by social incentive, in the case of U.S. universities identifying the benefit of technology transfer, or legislative creation, in the case of Japan and Korea. Effective Bayh-Dole legislation requires a government to enact and enforce patent laws, allow patent titles to be owned and controlled by universities, fund university research, and take a laissez-faire approach to the market and universities research activities. Universities need to respond by establishing employment contracts with policies and guidelines that encourage faculty to patent and building efficient market driven technology transfer offices. When governments and universities take these steps, it allows government funding to translate into industrial commercialization and economic success.