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Advancing University Innovation: More Must Be Expected—More Must Be Done

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I. INTRODUCTION

Far too much otherwise usable university research fails to find its way to advanced stages of research, commercial products, or other uses.[1] Given the fundamental nature of much university research, a certain amount of this research will appropriately reach its potential with publication and

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1. *See* PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY, REPORT ON TECHNOLOGY TRANSFER OF FEDERALLY FUNDED R&D: FINDINGS AND PROPOSED ACTIONS 7 (May 13, 2003) [hereinafter PRESIDENT'S COUNCIL 2003] ("[T]here is much technology resident in both sectors [university and industry] that is never commercialized."); RICHARD LAMBERT & NICK BUTLER, THE FUTURE OF EUROPEAN UNIVERSITIES: RENAISSANCE OR DECAY? 16, 55–56 (2006); Thomas J. Siepmann, *The Global Exportation of the U.S. Bayh-Dole Act*, 30 U. DAYTON L. REV. 209, 214 (2004) ("Unfortunately, in some cases, scientific discoveries were left unused and unapplied."); Marie C. Thursby, *Introducing Technology Entrepreneurship to Graduate Education: An Integrative Approach*, *in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 211, 214 (Gary C. Libecap ed., 2005) ("[O]nly a fraction of inventions with commercial potential are disclosed."); *see also* WENDY H. SCHACHT, TECHNOLOGY TRANSFER: USE OF FEDERALLY FUNDED RESEARCH AND DEVELOPMENT 11–17 (CRS Report for Congress, RL33527, July 19, 2007) [hereinafter SCHACHT, 33527] (arguing that the use of federal R&D results has remained restrained).

classroom instruction, but a substantial volume of these innovations instead deserves life in products, services, research tools and methodologies, and other uses. Unfortunately, exploitation of university innovations does not seem to be what it could be and is significantly below its potential for evolving to later stages of research, advancing human welfare, and spurring economic growth. Of course, there are success stories that should be celebrated, but when measured against potential and opportunity, much more must be expected from and more must be done by industry, government, universities, and their respective leaders.

Congress has declared and reiterated that our country's federal policy shall be to support and pursue the usefulness of the fruits of research conducted using federal money, including through increased collaboration between and among industry, universities, and government.[2] Congress has expressly stated

2. *See* Stevenson-Wydler Technology Innovation Act of 1980, 15 U.S.C. § 3701(3) (2006) ("Cooperation among academia, Federal laboratories, labor, and industry, in such forms as technology transfer, personnel exchange, joint research projects, and others, should be renewed, expanded, and strengthened."); 15 U.S.C. § 3701(8) (stating that there is a need for a comprehensive national policy to enhance technology transfer for commercial and public purposes, "including a strong national policy supporting domestic technology transfer and utilization of the science and technology resources of the Federal Government"); Bayh-Dole Act of 1980 (University and Small Business Patent Procedure Act of 1980), 35 U.S.C. § 200 (2006); Federal Technology Transfer Act of 1986, 15 U.S.C. § 3710 (2006) (amending the Stevenson-Wydler Technology Innovation Act of 1980); 15 U.S.C. § 271(b)(3) (stating the purpose of this chapter is "to advance, through cooperative efforts among industries, universities, and government laboratories, promising research and development projects, which can be optimized by the private sector for commercial and industrial applications . . . .") (referring to the National Technology Transfer Advancement Act of 1995, Pub. L. No. 104-113, 110 Stat. 775 (1996)); Cooperative Research and Technology Enhancement (CREATE) Act of 2004, Pub.L.No. 108-453 (amending 35 U.S.C. § 103(c) to address joint research agreements); Technology Transfer Commercialization Act of 2000, Pub.L.No. 106-404, § 2(1) (amending the Stevenson-Wydler Technology Innovation Act of 1980) ("[T]he importance of linking our unparalleled network of over 700 Federal laboratories and our Nation's universities with United States industry continues to hold great promise for our future economic prosperity.").

Wendy Schacht, who researches and writes for the Congressional Research Service, has discussed these and other federal statutes as they relate to federal policy and advancing innovation. *See* WENDY H. SCHACHT, THE BAYH-DOLE ACT: SELECTED ISSUES IN PATENT POLICY AND THE COMMERCIALIZATION OF TECHNOLOGY 7–8 (CRS Report for Congress, RL32076, Oct. 5, 2007) [hereinafter SCHACHT, 32076]; WENDY H. SCHACHT, INDUSTRIAL COMPETITIVENESS AND TECHNOLOGICAL ADVANCEMENT: DEBATE OVER

that "[i]t is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation's Federal investment in research and development."[3] Historically, this policy applied most directly to research by federal laboratories involving military, energy, and space applications.[4] More recently, the focus has broadened to embrace maximizing results of research that contributes to or can result in economic growth and advances in human welfare, beyond consumer-oriented derivatives of military, defense, and space technologies.[5] The focus also has expanded to include universities and other institutions that receive federal research grants. The most significant of the federal policy declarations in this regard is the Bayh-Dole Act of 1980.[6]

As stated in the Act, among the reasons Congress passed Bayh-Dole were "to promote the utilization of inventions arising from federally supported research and development" and to ensure "the public availability of inventions made in the

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GOVERNMENT POLICY 5-16 (CRS Report for Congress, RL33528 Aug. 1, 2007) [hereinafter SCHACHT, 33528]; WENDY H. SCHACHT, PATENT OWNERSHIP AND FEDERAL RESEARCH AND DEVELOPMENT (R&D): A DISCUSSION ON THE BAYH-DOLE ACT AND THE STEVENSON-WYDLER ACT (CRS Report for Congress, RL30320, Dec. 11, 2000) [hereinafter SCHACHT, 30320];

SCHACHT, 33527, *supra* note 1, at 11–17.

In addition, numerous states and local communities have been focusing on the economic development potential that can arise from properly exploiting the results of university-based research. *See* 15 U.S.C. § 3701(9) ("It is in the national interest to promote the adaption of technological innovations to State and local government uses."); 15 U.S.C. § 3702(3) (stating the Act's purposes includes "stimulating improved utilization of federally funded technology developments . . . by State and local governments and the private sector . . . ."); SCHACHT, 32076, *supra*, at 4–5; *see also* JERRY PAYTAS ET AL., UNIVERSITIES AND THE DEVELOPMENT OF INDUSTRY CLUSTERS (2004); LOUIS G. TORNATZKY ET AL., INNOVATION U.: NEW UNIVERSITY ROLES IN A KNOWLEDGE ECONOMY (2002); DIANE PALMINTERA, ACCELERATING ECONOMIC DEVELOPMENT THROUGH UNIVERSITY TECHNOLOGY TRANSFER (2005); W.R. Coffman, et al., *The Future of Technology Transfer at a Major Land Grant University: Report of the Cornell University Land Grant Panel on Technology Transfer*, 6 IP STRATEGY TODAY 1, 3–7 (2003).

3. 15 U.S.C. § 3710(a)(1) (2000).

4. SCHACHT, 30320, *supra* note 2, at 6–7 ("[W]hile the major portion of total federal R&D spending has been in the defense arena, government-financed work has led or contributed to new commercial products and processes, including, but not limited to, antibiotics, plastics, jet aircraft, computers, electronics, and genetically engineered drugs (e.g., insulin and human growth hormone)."); *see also* SCHACHT, 32076, *supra* note 2, at 2.

5. *See* 15 U.S.C. § 271(b)(3); 15 U.S.C. §§ 3701(3), (8), (9); 15 U.S.C. § 3702(3); 15 U.S.C. § 3710; 35 U.S.C. § 200.

6. 35 U.S.C. § 200 (2006).

United States . . . ."[7] Congress believed that these goals could be achieved most effectively by changing federal policy to uniformly allow institutions receiving federal research grants to own the resulting inventions and innovations, license them to others (even exclusively except for the general government license), generate revenue, and share the revenue with the researchers.[8]

Prior to passage of the Act, there were twenty-six different federal agency policies about using the results of federally funded research.[9] After the Act, there was one federal policy.[10] Consequently, responsibility for the results of federally funded research formally devolved from federal agencies to universities with a corresponding Congressional mandate to maximize the usefulness of such research results. Certain universities have done well in fulfilling their duties, but many others could do

7. *Id.*:

> 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.

8. 35 U.S.C. §§ 200, 202(a), 202(c)(1)-(3), 202(c)(7)(B).

9. SCHACHT, 32076, *supra* note 2, at.2; *see also* SCHACHT, 30320, *supra* note 2, at 4.

10. SCHACHT, 32076, *supra* note 2, at 2; SCHACHT, 30320, *supra* note 2, at 4 (The intent of the Bayh-Dole Act is to create "a single uniform national policy designed to cut down on bureaucracy and encourage private industry to utilize government funded inventions through the commitment of the risk capital necessary to develop such inventions to the point of commercial application.") (quoting H.R. Rep. No. 96-1307, pt. 1, at 3 (1980)); *see also* Sara Boettiger & Alan Bennett, *The Bayh-Dole Act: Implications for Developing Countries*, 46 IDEA 261, 278 (2006); Lorelei Ritchie de Larena, *The Price of Progress: Are Universities Adding to the Cost?*, 43 HOUS. L. REV. 1373, 1374, 1437 (2007) (arguing that the Bayh-Dole Act standardized rules regarding ownership of intellectual property and was a clear improvement over the prior set of complex, non-uniform rules).

better or have not done so well.[11]

Universities that seem to have been successful in advancing their innovations, whether before Bayh-Dole or after its enactment, have deployed different strategies and tactics for doing so, and there is much to be learned from their experiences and examples. Contrary to what some appear to believe, the most important lessons from these universities are not necessarily to replicate their tactics. Instead, the best lessons are those based on common characteristics these universities have in pursuing their advancing innovation efforts and, in the process, furthering federal policy. Among the characteristics these universities have in common are the following:

a. an informed, realistic vision for using and advancing university innovation in ways that complement specific academic and research missions, beyond merely chasing revenue;[12]

b. policies consistent with that vision and in furtherance of the Act's broad mandates;[13] and

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11. Gideon D. Markman et al., *Entrepreneurship and University-Based Technology Transfer,* 20 J. BUS. VENTURING 241 (2005) (discussing certain university technology transfer offices and evaluating their effectiveness); *see also infra* notes 12–19 and accompanying text about the revenue universities receive from advancing innovation activities, amounts spent on research, and ratios of spending per disclosure, new patent application, and patent issued.

12. As discussed below, such a vision should reflect the university's knowledge of its specific research strengths, personnel, and resources. The vision should also ensure that advancing innovation appropriately complements the university's core missions of teaching and research and does not sacrifice general service to human welfare and economic growth, which requires a realistic perspective on the role of revenue. *See, e.g.,* PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY, UNIVERSITY-PRIVATE SECTOR RESEARCH PARTNERSHIPS IN THE INNOVATION ECONOMY 69 (November 20, 2008) [hereafter PRESIDENT'S COUNCIL 2008] (regarding university-industry relationships, the Council determined that "[h]aving a clear vision from leadership . . . in developing and maintaining the partnership is vital for success" and a key element or guiding principle common among successful university-industry collaborations is a "shared vision and clear expectations").

13. This point is developed further below, but examples might include policies that permit different approaches to intellectual property ownership, use rights, and revenue; that allow for different approaches to risk allocation, including to the university, by addressing representations, warranties and indemnification in light of respective benefits to be gained, investments, ability to control, and overall exposure to downside losses. *See* Michael M. Crow, *Building an Entrepreneurial University, in* MAX PLANCK INSTITUTE AND EWING MARION KAUFFMAN FOUNDATION, THE FUTURE OF THE RESEARCH UNIVERSITY: MEETING THE GLOBAL CHALLENGES OF THE 21ST CENTURY, at 27

c. behaviors that advance the universities' innovations by pursuing that vision and implementing those policies.[14]

Unlike other articles about Bayh-Dole or advancing university innovation,[15] this article explores the links that should connect federal policy with the university's vision and the corresponding policies which in turn should be realized through related practices and behaviors. The absence or weakness of these links contribute to the unrealized potential of university innovations and are a reflection of how university leaders and their advisors have pursued or neglected federal policy and responsibilities under it.[16]

(2008) (explaining that Arizona State University has implemented policies that promote entrepreneurship and simplify moving "ideas into action" and that the University has "minimized" policies that discourage entrepreneurial behavior).

14. The following examples of behaviors that a university might consider, depending on its unique circumstances, are discussed in more depth below: factoring efforts to advance innovation (*e.g.*, disclosures) in tenure decisions; measuring the success of innovations in terms other than purely economic; pursuing volume in the amount of knowledge advanced rather than income derived; or encouraging equity interests instead of licensing fees that may hamstring a developing organization's cash flow.

15. There can be confusion about the terms "advancing innovation" and "technology transfer." Some people use "technology transfer" to refer more specifically to efforts to commercialize and the results of those efforts, frequently through patenting and licensing. Somewhat more broadly, others recognize that "technology transfer" may also encompass publication and other knowledge exchange media. In either of the latter contexts, "technology transfer" would be a subset of "advancing innovation" but the words are not synonymous. "Advancing innovation" seems to better reflect the broad mandate from Congress that universities maximize the usefulness of their innovations, not just commercialization of them (although commercialization should not be condemned or forgotten in the right circumstances).

In the body of this article and narrative parts of the footnotes, I try to use "advancing innovation" to refer to the processes and strategies by which universities maximize the usefulness of the innovations, including but not limited to commercialization activities, that result from their researchers' efforts in furtherance of the broader, fullest purposes of the Bayh-Dole Act. In parenthetical references in the footnotes, I use "technology transfer" more frequently because the authors cited use those words more often, and it can be difficult to discern whether the authors intend the words to mean commercialization, knowledge transfer, or Bayh-Dole's broader purposes. Changing the author's terminology in summarizing their points could be confusing and potentially distort their intended meaning.

16. Sara Boettiger & Alan B. Bennett, *Bayh-Dole: If We Knew Then What We Know Now*, 24 NATURE BIOTECHNOLOGY 320, 320 (2006) ("[N]egative consequences of Bayh-Dole can be traced to the institutional policies structured to optimize institutional benefits and income, rather than to the Act itself."); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 28

This article first presents a context for university leaders and their advisors to appreciate the importance of universities advancing their innovations as a vital matter of national interest, fulfilling an essential role in the new economy, and providing material educational benefits. This section also discusses the reasons some posit to oppose advancing innovation, most notably the inevitable conflicts of interest and other ethical concerns that arise from university engagement with industry, which is inherent in advancing innovation activities. Finally, the first section concludes with perspectives on ways to manage ethical matters, which Congress must have intended by promulgating federal policy that mandates university-industry interaction.

The article next summarizes debate about the Bayh-Dole Act's effectiveness as federal policy and why some mistakenly attribute failures in advancing innovation to the Act instead of to how the Act has been implemented by university leaders and policy makers. The article then considers the importance of a customized institutional vision for advancing innovation that complements academic and research missions, is informed by knowledge of the specific university itself, and reflects a proper perspective on revenue potential and risk allocation. Finally, the article concludes by relating how that unique vision should consistently inform university policies and behaviors regarding such legal and practical topics as intellectual property strategies, allocating liability, invention disclosures, and measures of success.

It would be naïve to suggest that inadequacy of results in advancing university innovation rests wholly with universities or how leaders and their advisors steward such efforts. Industry is not without responsibility. Other factors also contribute—most notably the lack of available funds. For example, research suggests that capital is inadequate to bridge the "valley of death" for many potential products and otherwise useful innovations at intermediate stages of the

("successful technology transfer negotiations often depend on individual efforts, particularly those of the leadership, from each organization having a strong desire to establish partnerships"); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 29 (negotiations could be shorter and less time consuming "if a few key factors were present, such as continued commitment from leadership"); Crow, *supra* note 13, at 26–27 ("Many universities have a wide range of such constraints [on entrepreneurial behavior]—the kinds of policies that can inhibit decision-making, deaden creative thinking, and turn deans into paper-pushers.").

commercialization process.[17] Industry behavior, the valley of death, and other factors that inhibit whether and how university innovations advance should not interfere with efforts to scrutinize and encourage change in university approaches, including by expanding vision to correspond to the broad purposes of Bayh-Dole and implementing corresponding policies and behaviors beyond hoped for financial gains.

This article focuses on certain factors within the control of university leaders and their advisors, many of whom are from the legal profession, and should not be construed as forgiving or ignoring the need to address other factors that interfere with advancing university innovations to their potential. The focus on university leaders and their advisors is intended to facilitate fulfillment of their responsibilities under federal policy and as stewards of federal grant dollars, hopefully resulting in fewer orphaned innovations, better opportunities for economic growth, and expanded human welfare.

II. CONTEXT FOR ADVANCING UNIVERSITY INNOVATION

The more traditional roles of universities in teaching and basic research are critical means by which universities advance knowledge, pursue innovation, and contribute to the well-being of society, and this article is not intended to detract from the importance of those contributions.[18] Instead, this article

17. *See, e.g.*, GEORGE S. FORD ET AL., A VALLEY OF DEATH IN THE INNOVATION SEQUENCE: AN ECONOMIC INVESTIGATION 1 (2007); Phillip Auerswald & Lewis M. Branscomb, *Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States*, 28 J. TECH. TRANSFER 227 (2003); Charles W. Wessner, *Driving Innovations Across the Valley of Death*, 48 RES. TECH. MGT. 9 (2005).

18. *See* CREST OMC EXPERT GROUP ON INTELLECTUAL PROP., INTELLECTUAL PROPERTY: COLLABORATION BETWEEN PUBLICLY FUNDED RESEARCH ORGANISATIONS AND INDUSTRY AND TECHNOLOGY TRANSFER TRAINING 26 (2006) [hereinafter CREST REPORT], *available at* http://ec.europa.eu/invest-in-research/pdf/download_en/crestreport.pdf; *see also* Mark Crowell, *The Changing Face of University Technology Transfer*, *in* EWING MARION KAUFFMAN FOUNDATION, KAUFFMAN FOUNDATION THOUGHTBOOK 2005, at 108 (2005) (roles of university are teaching, research, public service, and economic development); ANNA S. NILSSON ET AL., COMMERCIALIZATION OF LIFE-SCIENCE RESEARCH AT UNIVERSITIES IN THE UNITED STATES, JAPAN AND CHINA 11 (2006), *available at* http://www.itps.se/Archive/Documents/Swedish/Publikationer/Rapporter/Allm%E4nna/A2006/A2006_006%20webb.pdf (primary missions of universities to "create and disseminate knowledge by teaching and performing research" but

focuses more specifically on university service and responsibility in light of the purposes stated in the Bayh-Dole Act. Before delving more deeply into a discussion about how universities implement the Act, it is important to understand the context in which university undertake efforts to advance their innovations.

This section discusses the role of advancing innovation in the new economy and the importance of that role as a matter of our nation's economic and human welfare. This section also identifies educational benefits gained from university efforts in this regard. Finally, this section presents the primary positions against advancing innovation and a rebuttal that managing ethical problems, rather than capitulating to them or isolating oneself from them, can simultaneously protect academic integrity and ensure that innovations are utilized.

A. NEW ECONOMY AND NEW IMPORTANCE FOR UNIVERSITY INNOVATIONS

Innovations derived from universities, hospitals, and research institutions—referred to collectively in this article as "universities"—have transformed our communities, nation, and our world in exciting and fulfilling ways. Although university innovations have contributed much to economic opportunity and human welfare over the past century,[19] the outcomes often have been byproducts of an alternative purpose, such as military defense or space exploration. A new reality has evolved in recent decades in which universities pursuing their research missions are now positioned to catalyze innovation and economic growth and improve the human condition.[20] This

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also contribute to innovation process through education and training, adding to stock of codified knowledge, increase local capacity for problem solving, and provide public space for conversations on development pathways and new knowledge).

19. *See* 15 U.S.C. § 3701(2) ("Technology and industrial innovation offer an improved standard of living, increased public and private sector productivity, creation of new industries and employment opportunities, improved public services and enhanced competitiveness of United States products in world markets."); SCHACHT, 30320, *supra* note 2, at 9 (Technology transfer "can generate economic growth in the form of new jobs, [and] greater productivity."); DAVID C. MOWERY ET AL., IVORY TOWER AND INDUSTRIAL INNOVATION: UNIVERSITY-INDUSTRY TECHNOLOGY TRANSFER BEFORE AND AFTER THE BAYH-DOLE ACT IN THE UNITED STATES 7, 12–13, 15–19 (2004).

20. *See* LAMBERT & BUTLER, *supra* note 1, at 15 (noting how universities should *not* be managed to improve use of resources); *see also* Thursby, *supra* note 1, at 212 ("University discoveries and inventions are increasingly

university role has gained significance as large corporations have jettisoned or changed the foci of their internal laboratories.[21]

Wendy Schacht, a member of the Congressional Research Service who has written extensively for Congress on advancing university innovation, characterizes federal research and development grant money as serving a "critical national need"[22] and being "vital to the nation's welfare and security"[23] because of the economic growth derived from the commercialization of the results of federally funded research.[24] Moreover, she

becoming the engine of entrepreneurship and technological advance for start-ups and established companies."); G. Pascal Zachary, *Corporate Labs Disappear. Academia Steps In.*, N.Y. TIMES, Dec. 16, 2007, at §3; *cf.* 15 U.S.C. § 3701(3) ("Many new discoveries and advances in science occur in universities and Federal laboratories."); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 1 ("[u]niversities continue to serve as a primary engine for discovery research that can lead to innovation"); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 5, 7 (strengthening and expanding university-private sector relationships is "vital" to continued innovation and the "health of U.S. [research and development], and ultimately to the technology-based economy"); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 37 (such relationships "are one vital element of the U.S. innovation ecosystem" and is increasingly important in light of "long-term Federal funding trends and increased global competition"); Crow, *supra* note 13, at 11 (the roughly 150 public and private "research extensive" universities" are "the institutions that increasingly fuel the national economy by producing leaders in all sectors of academia, business, industry, and government, and through perpetual innovation in products and processes"); Crow, *supra* note 13, at 18 (higher education "is the source of economic growth and advances in our society. Our colleges and universities play a key role in ensuring that, as a nation, we will continue to lead the world in innovation, maintain our competitive advantage, and weave the fabric of economic prosperity.").

21. *See* David Rotman, *Special Report: R &D '04: Technology Review's Annual Look At Corporate Research Trends And Numbers Including The R &D Spending Of 150 Top Technology Companies, Plus Profiles Of Three Hot Research Project, in* TECHNOLOGY REVIEW (2004), *available at* http://www.technologyreview.com/computing/13988/?a=f; *The Rise and Fall of Corporate R&D,* ECONOMIST, Mar. 1, 2007, *available at* http://globaltechforum.eiu.com/index.asp?layout=rich_story&doc_id=10225&title=The+rise+and+fall+of+corporate+R%26D&categoryid=15&channelid=5; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 1 (noting trend of industry to reduce basic research, "notably the disappearance of Bell Labs"); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 5 (reduced number and size of industry labs forces more reliance on academic and government labs for basic research output).

22. SCHACHT, 33528, *supra* note 2, at 7.

23. SCHACHT, 33527, *supra* note 1, at 3.

24. SCHACHT, 33528, *supra* note 2, at 7; SCHACHT, 33527, *supra* note 1, at 3; PRESIDENT'S COUNCIL 2008, *supra* note 12, at 5; *see also* Crow, *supra* note

asserts that "[n]ational security is now being redefined to include economic well-being in addition to weapons superiority."[25]

The economic model that existed previously in the United States and much of the developed world was driven by a triumvirate of government, big business, and unions focused on industrial or manufacturing activities.[26] The United States, European Union, India, parts of Asia, and elsewhere, however, have moved into a different economic dynamic. In the new, entrepreneurial economy of the United States and elsewhere, universities and entrepreneurs have joined government and big business as the key players, and knowledge and service are the essential ingredients.[27] In this new paradigm, university research and its potential contribute to advancing quality of life through the development of new products and services, new ways of providing services, new approaches to productivity and efficiency, new jobs, and new sources of capital.[28]

Federal policy and duty to society obligate research universities to maximize the potential for their innovations because they are integral to the new economy. They should fulfill that obligation in a way that reflects the new, entrepreneurial economy. To the extent vestiges of the old economy and its linear processes and measures remain in university policies and practices, opportunities for

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13, at 30 ("It is essential to realize that continued economic growth depends upon innovation and that the global economy operates according to the forces of 'creative destruction,' described by economist Joseph Schumpeter nearly a century ago.").

25. SCHACHT, 33527, *supra* note 1, at 15; *see also* Crow, *supra* note 13, at 30 ("It is incumbent on universities as never before to help solve the pressing global issues of our time: population growth, climate change, national and international security.").

26. *See* TORNATZKY ET AL., *supra*, note 2; CARL J. SCHRAMM, THE ENTREPRENEURIAL IMPERATIVE 24 (2006).

27. *See* David B. Audretsch et al., *The Knowledge Spillover Theory of Entrepreneurship and Technological Diffusion, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 69, 84 (Gary C. Libecap ed. 2005) (distinguishing neoclassical tradition focus on investment in physical capital from the endogenous growth theory focused on accumulated knowledge or knowledge capital).

28. *S*ee SCHACHT, 33528, *supra* note 2, at 2; *see also supra* note 16 and accompanying text; *cf.* SCHRAMM, *supra* note 26, at 152 ("Our economic growth depends more and more on the success of our research institutions. Constant innovation and the entropic expansion of knowledge place enormous demands on universities.").

contributions to economic growth, human welfare, and other benefits are likely to be imperiled.

B. EDUCATIONAL BENEFITS OF ADVANCING UNIVERSITY INNOVATION

People frequently consider money as the primary benefit to a university that advances its innovations, but money may be among the least important. Yes, revenue is available from royalties, license fees, equity positions and options, and sponsored research. In addition, success and good experiences can increase donations from alumni and others associated with the university experience, which can enhance labs, facilities, equipment, endowed chairs, and more.[29] However, there are direct benefits to the university's core academic mission, too. Evidence suggests that when universities engage well with business and strive to maximize their innovation potential, faculty, students, and the university itself can experience profound educational benefits.[30]

For faculty, the experience of engaging with industry while advancing innovations can enhance professional development and lead to coaching or mentoring relationships and other experiences that benefit them in the lab and the classroom.[31]

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29. *See* PALMINTERA, *supra*, note 2 (Among the ways industry can help universities are by funding laboratories and equipment, sponsoring research, endowing chairs, serving on advisory boards, mentoring researchers and students, providing opportunities for student interns and CEO-in-residence program; moreover, these interactions and exchanges facilitate the flow of information between academia and the so called "real world," thereby strengthening both; industry benefits by increased access to innovation, students, employees, and knowledge.); *see also* Donald Siegel et al., *Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices: An Exploratory Study*, 32 RESEARCH POL'Y 27, 31(2003) [hereinafter Siegel Study]; Markman et al., *supra* note 11, at 255; PRESIDENT'S COUNCIL 2008, *supra* note 12, at 71.

30. David C. Mowery, *The Bayh-Dole Act and High-Technology Entrepreneurship in U.S. Universities: Chicken, Egg, or Something Else? in* Colloquium on Entrepreneurship Education and Technology Transfer, University of Arizona 1 (2005); *see also* PRESIDENT'S COUNCIL 2003, *supra* note 1, at 14; SCHACHT, 32076, *supra* note 2, at 4–5; Donald Siegel et al., *Commercial Knowledge Transfers from Universities to Firms: Improving the Effectiveness of University-Industry Collaboration*, 14 J. HIGH TECH. MGMT. RES. 111, 130 (2003); Siepmann, *supra* note 1, at 233.

31. DEREK BOK, UNIVERSITIES IN THE MARKETPLACE: THE COMMERCIALIZATION OF HIGHER EDUCATION 6–7 (2004); COUNCIL ON GOVERNMENTAL RELATIONS, TECHNOLOGY TRANSFER IN U.S. RESEARCH UNIVERSITIES: DISPELLING COMMON MYTHS 3 (2000); Donald Siegel et al.,

In the lab, researcher interactions with business might help them keep current with or get ahead of trends and recognize new, different opportunities for their existing or future research or its results.[32] Researchers and faculty also might better understand valuation, development, and commercialization processes.[33] In the classroom and as advisors, such faculty might have more credibility, be able to relate more tangibly to their students' work aspirations, and provide a better window into real world content applications and processes.

For students, hands-on research opportunities increase knowledge and marketability. Working with professors who have commercialized innovations can improve what and how the students learn and can open doors for internships, fellowships, advanced education, and jobs—all of which also benefit industry and our society.[34]

These interactions, between universities and industry, also contribute to the mutually beneficial social networks that facilitate research collaborations, shared ideas, healthy debate,

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Toward a Model of the Effective Transfer of Scientific Knowledge from Academicians to Practitioners: Qualitative Evidence from the Commercialization of University Technologies, 21 J. ENGINEERING & TECH. MGMT. 115, 119 (2004); Audretsch, *supra* note 27; Markman et al., *supra* note 11, at 255; Peter J. Harrington, *Faculty Conflicts of Interest in an Age of Academic Entrepreneurialism: An Analysis of the Problem, the Law and Selected University Policies*, 27 J.C. & U.L. 775, 786 (2001) (quoting A. Bartlett Giamatti); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 61 (faculty can gain a better understanding of industry needs and the applications of their research); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 71 (increases faculty professional development and better educates students through "faculty who can share these experiences" from interacting with industry).

32. Siegel, *supra* note 31, at 29–30; *see also* COUNCIL ON GOVERNMENTAL RELATIONS, *supra* note 31, at 16; Siegel, *supra* note 30, at 130; PRESIDENT'S COUNCIL 2008, *supra* note 12, at 71 (allows faculty research directions to be on the leading edge).

33. PALMINTERA, *supra* note 2, at 12.

34. COUNCIL ON GOVERNMENTAL RELATIONS, *supra* note 31, at 15–16; *see also* LAMBERT & BUTLER, *supra* note 1, at 57; PALMINTERA, *supra* note 2, at 12; TORNATZKY ET AL., *supra* note 2, at 14; Gary Libecap, *Introduction, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY ix (Gary Libecap ed., 2005); Siepmann, *supra* note 1, at 233; Zachary, *supra* note 20; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 61 (students have the opportunity to conduct research "highly relevant" to industry and to experience the "real world"); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 71 (leads to internships and employment opportunities and industry personnel can provide assistance with student projects, serve on thesis committees, and guest lecture).

and constructive friction.[35] These interactions allow for the direct flow of ideas from the university to business and vice versa across a wide range of disciplines and the full panoply of basic to applied research.[36] As Laszlo Barbási's research at the University of Notre Dame suggests, this flow of ideas within and across networks and along their nodes frequently forms the genesis of new opportunities and perspectives, particularly when such flow is across nodes and networks that might lack familiarity with each other.[37] Andrew Hargadon at the University of California-Davis points out that ideas bridging worlds promote innovation.[38]

Moreover, university-business relationships can enhance the university's reputation, thereby allowing it to recruit higher quality faculty, who attract more research funding that yields advances in research and results, which perpetuates a cycle—all to the benefit of faculty, students, and the university.[39]

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35. ANNA S. NILSSON ET AL., COMMERCIALIZATION OF LIFE-SCIENCE RESEARCH AT UNIVERSITIES IN THE UNITED STATES, JAPAN AND CHINA 17 (2006), *available at* http://www.itps.se/Archive/Documents/Swedish/Publikationer/Rapporter/Allm%E4nna/A2006/A2006_006%20webb.pdf ; Siegel, *supra* note 30, at 126; *see also* Andrew Nelson & Thomas Byers, *Organizational Modularity and Intra-University Relationships Between Entrepreneurship Education and Technology Transfer, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 275 (Gary Libecap ed., 2005) (describing that networks between entrepreneurship education and the engineering schools are critical and foster technology transfer and entrepreneurship); Donald S. Siegel & Phillip H. Phan, *Analyzing the Effectiveness of University Technology Transfer: Implications for Entrepreneurship Education, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 28 (Gary Libecap ed., 2005) (noting that ties between star scientists and firm scientists have a positive effect on technology transfer).

36. Siegel, *supra* note 30, at 130.

37. ALBERT- LÁSZLÓ BARBÁSI, LINKED: HOW EVERYTHING IS CONNECTED TO EVERYTHING ELSE AND WHAT IT MEANS FOR BUSINESS, SCIENCE, AND EVERYDAY LIFE 43, 61, 212 (2003); *see also* NILSSON ET AL., *supra* note 35 (finding that interaction between research and market actors helps to develop discovery); Markman et al., *supra* note 11, at 255 ("[T]he frequent engagement with the university's scientists to advance the technology can lead to substantial knowledge spillover effects.").

38. Ewing Marion Kauffman Foundation, *Understanding the Innovation Process: The Power of Social Networks, An Interview with Andrew Hargadon, in* KAUFFMAN THOUGHTBOOK 2005, 122 (2005); Audretsch et al., *supra* note 27, at 84 (explaining the importance of social capital and social networks in generating economic growth).

39. *See* Libecap, *supra* note 34, at ix; s*ee also* PRESIDENT'S COUNCIL 2008,

However, there are those who contend that the university's reputation and scientific integrity suffer because of ethical problems associated with university efforts to advance innovations.[40]

C. ETHICAL OPPOSITION TO ADVANCING INNOVATION

Those who oppose advancing university innovation contend that university collaboration with industry compromises academic freedom and research integrity, which creates a downward spiral of destruction instead of a virtuous cycle of advancement.[41] It is important to understand these divergent views to counter them when suspect and address them when valid. Additionally, since a federal policy that extols utilization of research results implicitly requires the results and processes by which they were achieved be and appear to be credible and reliable,[42] it is incumbent on university leaders and their advisors to ensure that their advancing innovation programs competently address legitimate ethical concerns.

1. Conflicts of Interest and Other Ethical Problems

Even before the Bayh-Dole Act, universities worked with industry in numerous ways. Among these are seemingly innocuous charitable contributions (which can sometimes seem harmful) as part of ordinary fundraising efforts.[43] Other examples include sponsored-research initiatives, engagements with university researchers as consultants or advisors, and arrangements where researchers and the university share royalties, license fees, and equity ownership with industry. Some worry that these latter types of interactions give rise to inherent and nearly universal conflicts of interest and

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supra note 12, at 34 (university-industry relationships increase "mutual understanding of organizational missions, abilities, and constraints, and generally builds trust between partners, a prerequisite for formalized partnerships").

40. *See infra* notes 35–45.

41. *See infra* notes 35–45; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 69 (recognizing that some academics believe that funding from industry negatively affects research and that universities must work to change those perceptions).

42. *See supra* note 2.

43. Richard E. Just & Wallace E. Huffman, *The Role of Patents, Royalties, and Public-Private Partnering in University Funding*, *in* ESSAYS IN HONOR OF STANLEY R. JOHNSON, Article 7, 2 (2006), *available at* http://www.bepress.com/sjohnson/art7.

commitments that are inappropriate and cannot effectively be reconciled.[44]

Such opponents argue that through such interaction, the reliability of substantive research suffers because business can or can be perceived to bias the choice and design of research questions, how research is assigned to students,[45] and criteria or characteristics of those to be tested.[46] Critics argue that university-industry interactions compromise objectivity and that industry will try to unduly influence research topics, methods, results, and even the substantive reports themselves.[47] These concerns are legitimate, and this influence can exist (or be perceived to exist) even if those involved are of impeccable, ethical character.[48]

Opponents also contend that ethical conflicts threaten academia itself by distracting from teaching and basic research,[49] undermining collegiality,[50] encouraging secrecy,[51]

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44. See BOK, *supra* note 31 at 66–67; Harrington, *supra* note 31, at 787; SCHACHT, 32076, *supra* note 2, at 18–23; *see also* Dick Thornburgh, *Building and Retaining Trust in the Biomedical Community*, 74 CLEV. CLINIC J. MED. (SUPP.) S38, S39 (2007).

45. Harrington, *supra* note 31.

46. *Id.* at 776, 779; SCHACHT, 32076, *supra* note 2, at 19–20 (citations omitted).

47. *See* Harrington, *supra* note 31, at 776, 788; BOK, *supra* note 31, at 71–76; SCHACHT, 32076, *supra* note 2, at 19; *see also* Thornburgh, *supra* note 44, at S40 ("[B]usiness considerations may inappropriately influence medical care, purchasing decisions, and clinical research findings."); JENNIFER WASHBURN, UNIVERSITY INC.: THE CORPORATE CORRUPTION OF HIGHER EDUCATION 75 (2005) ("[C]orporate sponsors may be manipulating manuscripts or suppressing unwelcome research to serve their commercial interests."); WASHBURN, *supra*, at 81 ("Far more common are instances where corporations exert influence over academic research that is more subtle—and hence more difficult to detect."); WASHBURN, *supra*, at 84 (such as pre-selecting favorable scholars); WASHBURN, *supra*, at 110 (control over trial design); WASHBURN, *supra*, at 112 (publish favorable points and bury less favorable); WASHBURN, *supra*, at 113 (suppressing negative studies).

48. BOK, *supra* note 31, at 67; *see also* WASHBURN, *supra* note 47, at 111 (using high profile academic "guest writers" can lead to imputed credibility "when this is nothing more than an illusion").

49. Harrington, *supra* note 31, at 780; BOK, *supra* note 31, at 64, 111; WASHBURN, *supra* note 47, at 32; SCHACHT, 32076, *supra* note 2, at 20. *But see* BOK, *supra* note 31, at 142 ("Two decades of experience reveals no significant tendency to abandon basic research for more profitable kinds of applied or practical work. Nor could anyone observing the growing numbers of learned journals and scholarly books make a convincing case that serious scholarship has suffered . . . . [T]he urge for discovery and the desire for respect from worthy colleagues have been more than a match for the lure of making

preventing or delaying publication,[52] and devaluing humanities and social sciences.[53] Ironically, some universities have at times demanded publication restrictions, transfer prohibitions, and rights to future discoveries even though they might invoke their own academic and research mission to object when others seek to apply these restrictions to them.[54]

Unfortunately, compromised integrity in academia is not new nor is it limited to relationships involving industry.[55] Such problems existed before the Bayh-Dole Act passed in 1980, and

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money."); Katherine J. Strandburg, *Curiosity-Driven Research and University Technology Transfer, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 94 (Gary Libecap ed., 2005) (citing that the evidence is mixed on whether increased patenting caused scientists to shifted toward more applied research).

50. BOK, *supra* note 31, at 113; Siegel, *supra* note 30, at 129; CREST REPORT at 27.

51. See Siegel, *supra* note 30, at 127; Harrington, *supra* note 31, at 788; BOK, *supra* note 31, at 64, 203–04; MOWERY ET AL., *supra* note 19, at 1,185 (citations omitted); SCHACHT, 32076, *supra* note 2, at 14; WASHBURN, *supra* note 47, at 75; Margo A. Bagley, *Academic Discourse and Proprietary Rights: Putting Patents in their Proper Place*, 47 B.C. L. REV. 217, 221, 251, 253, 263 (2006). *But see* Strandburg, *supra* note 49, at 94 (stating that it is unclear whether increase in university patenting resulting from the Bayh-Dole Act is connected to increasing delays and secrecy).

52. WASHBURN, *supra* note 47, at 75; Bagley, *supra* note 51, at 240.

53. WASHBURN, *supra* note 47, at 23–24, 33 (quoting Robert Berdahl from the University of California Berkeley about "a corresponding devaluation of the work of humanists and social scientists").

54. Ritchie de Larena, *supra* note 10, at 1420 (citing and quoting from a study by the National Institutes of Health).

55. BOK, *supra* note 31, at 114; WASHBURN, *supra* note 47, at 33 ("Many of the fundamental tensions that continue to pervade higher education today—. . . the struggle between preserving autonomy and serving outside interests—first surfaced in the nineteenth century."). Researchers have been known to fabricate data and manipulate analyses and results solely in the name of tenure, publication, or reputation, without any reason to consider money or business relationships. Relying on human frailty to argue that universities should not engage with industry is tantamount to arguing that human nature cannot be controlled, moderated, or trusted. Pursuing such an argument to its logical conclusion would justify eliminating research conducted by humans who work at universities. Rather than eliminate university-industry relationships, the more reasonable course is to acknowledge both the potential and weakness inherent in the human condition and then institute policies and practices to effectively manage those relationships to minimize the potential for lapses. *See* James G. Sheehan, *Fraud, Conflict of Interest, and Other Enforcement Issues in Clinical Research,* 74 CLEV. CLINIC J. OF MED. (SUPP.) S63-S66 (2007) (arguing that fraud in scientific research is a widespread problem, with examples including Sigmund Freud, Isaac Newton, Louis Pasteur, and Gregor Mendel); *see also* Siepmann, *supra* note 1, at 242 (noting that financial conflicts of interest have been in place since government started funding research in 1950).

they existed before universities increased their involvement with industry[56] Therefore, it is disingenuous to blame Bayh-Dole or increased innovation for the ethical problems that exist in academia. Furthermore, it is fallacious to suggest that if universities barred or abandoned their efforts these ethical problems would end. Regardless, opponents are correct that ethical lapses can threaten safety, health, and the welfare of individuals,[57] and ultimately impact industry and its bottom line.[58]

Industry has a vested interest in preserving academic and research integrity or it risks losing money invested in developing products based on faulty research, their profit potential, and opportunities lost because of the wasted time and focus.[59] Such problems also can affect the quality of the workforce and can devastate companies and their employees, creditors, investors, and even communities. In addition, ethical lapses can undermine reliability of research results that are or are perceived to be compromised.

There is validity to the concerns raised by opponents and critics of university–industry relationships, but neither the problems nor the solutions should be overblown. Fortunately, opponents of such relationships are not the only ones concerned about the negative (and even potentially destructive) impact of un-reconciled ethical problems. Among the differences, however, is that purist opponents appear prepared to forgo the economic growth, advances in human welfare, and other benefits of university–industry relationships while others recognize that these benefits are valuable enough to justify reconciling these problems appropriately.[60] Congress appears

56. *See infra* notes 80–81

57. Harrington, *supra* note 31, at 776; MOWERY ET AL., *supra* note 19, at 191.

58. *See* Harrington, *supra* note 31, at 797–98.

59. *See generally* WASHBURN, *supra* note 47, at 190–97 (quoting industry representatives who complain about universities focusing on "profit-maximizing" behavior and neglect their roles as educators, innovators, and experimenters).

60. *See* Harrington, *supra* note 31, at 783 (noting attempts at regulation instead of elimination of university faculty conflicts of interest); BOK, *supra* note 31, at 203–04 (urging universities to be "more vigilant in guarding their basic academic values"); SCHACHT, 32076, *supra* note 2, at 19 (quoting Katherine Ku from Stanford University's Office of Technology Licensing about the need to evaluate the criticisms of the Bayh-Dole Act); *see also* Zachary, *supra* note 20 (explaining that risk of interference from industry and limits on

to be among the latter.[61]

2. Managing Ethical Problems, Respecting Academic Freedom, and Advancing Innovation

In passing the Bayh-Dole Act, Congress intended for universities to engage with industry.[62] Congress must have understood the possibility that such interaction could give rise to conflicts of interest and other ethical problems. Yet, Congress set federal policy as it did, from which we may extrapolate that Congress expected the individual universities to manage those problems, not to avoid or to over-react to them. It does not follow that federal policy would tolerate the systematic prohibition of interaction with business or other draconian measures. Instead, it does follow that Congress expects the university—particularly its leadership and advisors—to balance the benefits to be gained from engagement against the difficulties of conflicts of interest and other ethical quandaries.[63]

Of course, given human nature and the dangers of financial corruption, nothing is foolproof, but a properly aligned pecuniary interest can motivate disciplined compliance with academic integrity and ethical norms. Policies and procedures appropriate to the university's circumstances can minimize the ethical risks and promote potential gains by ensuring that those involved from the university and business are clear on expectations. Clear expectations can guide those with good will and judgment to pursue the legitimate benefits of university-

academic freedom seem "small"); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 69 (recommending that universities address the view among some academics that funding from industry negatively affects research).

61. *See infra* note 62 and accompanying text.

62. *See* 35 U.S.C. § 200 ("It is the policy and objective of the Congress . . . to promote collaboration between commercial concerns and nonprofit organizations, including universities."); *see also supra* note 2.

63. Harrington, *supra* note 31, at 808 (quoting University of California conflict of interest disclosure policy: whether "potential public benefits to be gained outweigh any potential erosion of academic freedom, collegiality, or public trust"; and quoting University of Miami conflict of interest disclosure policy, "the potential negative impacts that may arise from a significant financial interest are outweighed by interests of scientific progress, technology transfer, or the public health and welfare, then the University may allow the project to go forward without imposing such conditions or restrictions"); *see also* Edward D. Miller, *Creating an Institutional Conflict-of-Interest Policy at Johns Hopkins: Progress and Lessons Learned,* 74 CLEV. CLINIC J. MED. (SUPP.) S70 (2007) (arguing that academic medical centers should focus on managing conflict of interest risks).

industry relationships. Jennifer Washburn, journalist, author, and fellow at the New America Foundation, attempts this ethical balancing act by proposing that universities prohibit anyone in key research positions from having personal financial ties or equity interests in any enterprise that might benefit from the research.[64] She also recommends that grant recipients be barred from holding executive positions with or serving in advisory capacities to companies that might benefit from the research both when the research is undertaken and for one or two years thereafter.[65]

While these suggestions perpetuate strong ethical standards, they seem to overstate the bad in people. Although potentially appropriate in unique situations at a given university whose reputation has been denigrated, broad adoption of Washburn's or similar suggestions could discourage pursuit of critical research, inhibit innovation, and deny access to fundamental knowledge and experience. Among the problems with Washburn's suggestions is the prospect that just about anyone could benefit financially from the researcher's work except the people with the best knowledge of the research, its applications, and who also took the greatest professional risks.

In his review of Washburn's book, J. Steven Rutt, Ph.D., a practicing attorney and author, characterizes her concerns as "partially valid but reflect[ing] a narrow, if not distorted, idealism about big university life, bordering on naiveté."[66] He continues that a "university divorced from commerce can easily become a microcosm of its own, driven by egos, elitism, petty rivalry, and hunger for grant money."[67] Rutt dismisses Washburn's suggestion for the pursuit of "[a] purely academic focus, divorced from common sense, ethical thinking, public service, the real world, and traditional ideals of academia [that] is not a desirable alternative to the status quo."[68]

Stated another way, Washburn's recommendations do not effectively balance the relevant competing interests enough to

64. WASHBURN, *supra* note 47, at 235

65. *Id.*

66. J. Steven Rutt, *Bayh-Dole and Nanotechnology: A Review of* University Inc.: The Corporate Corruption of Higher Education, 2 NANOTECH L. & BUS. 405, 407 (2005) (book review).

67. *Id.* at 409.

68. *Id.*

justify its universal adoption or even consideration. Certain institutions may find her recommendations necessary, particularly if they need to rebuild lost or tarnished trust. Integrity and credibility can be appropriately protected, however, without implementing such extreme steps and incurring the accompanying lost opportunities and potential unfairness.

The primary strategies for solving the problems Washburn and others present are various degrees of transparency to funders, administrations, publishers, and the public regarding following:

a. grants, sponsorships, and other sources of funding toward related research, equipment, personnel, etc.;

b. the identities of collaborators and even those who shaped research questions, protocol, and methodology; and

c. sources, types and amounts of consulting, advising, and investing revenue and extent of time spent away from academic responsibilities in pursuit of such revenue.

Other complementary strategies that universities have adopted include increased oversight over research and its protocols, replication of research results by uninvolved neutral researchers, leaves-of-absence for the researcher, diversified sources of funding to protect against dependency and the corresponding leverage (real or perceived), limiting delays in publication to minimally necessary time requirements, setting reasonable limits on compensation researchers may receive in conflicted circumstances,[69] and establishing panels or other informed resources to provide perspectives on specific situations. The degree to which universities incorporate these and other strategies may depend on the degree of the university's involvement with industry and the sophistication of the university's leadership, advisors, and researchers.

In addition, effective university conflicts-of-interest and ethics programs should require education for researchers and funders and impose consequences for violators. Education and training can ensure both awareness of the procedures and

69. For instance, the Mayo Clinic does not accept royalty payments and does not permit its researchers to accept such payments on commercial tests any Mayo physician may order. Interview with Michael J. Ackerman, M.D., Ph.D., Director of the Long QT Syndrome Clinic at the Mayo Clinic, in Rochester, MN (Aug. 12, 2008). Mayo has adopted this approach to ensure that patients can be confident that such tests are not motivated by pecuniary interests. *Id.*

understanding about why they exist, which can enhance compliance.

Some might find it unnecessary to implement consequential punishment in their conflicts-of-interest programs, because of the threat that a researcher's reputation and the credibility of his or her research may suffer, that he or she may have difficulty obtaining or keeping tenure, a job, or grant funding, or that he or she may be liable for civil or criminal remedies. The university must be able to protect itself and preserve its reputation, however, and the ability to mete out consequences can help.

When a researcher(s) or others conclude that the benefits of unethical behavior outweigh the likelihood of getting caught or attendant harm, appropriately promulgated and imposed consequences can motivate compliance and deter others from non-compliance.[70] In addition, having the ability to impose consequences may be critical for the university and its leadership to minimize damage to institutional trust and integrity. Consequences are likely to differ between tenured and non-tenured faculty but should refer to a spectrum that includes demotion, reassignment, disgorgement, suspension, and even termination.

Ironically, academia itself—whose members are among the most vociferous opponents of university engagement with industry—can impose serious consequences for severe ethical lapses, but is reluctant to do so.[71] Their opposition, in the

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70. For example, when former Treasury Secretary Paul O'Neill became CEO of Alcoa he identified worker safety as a key priority. Early in his tenure, he terminated a highly ranked employee, who many viewed as a superstar, because he failed to report an injury within 24 hours of its occurrence as required by safety rules. Alcoa's accident rate went down to virtually zero. *See* Susan H. Ehringhaus et al., *Guidelines and Performance: Creating a Culture of Ethics*, Panel Discussion, 74 CLEV. CLINIC J. OF MED. (SUPP.) S77, S77–S78 (2007).

71. *See* John G. Bruhn et al., *Moral Positions and Academic Conduct: Parameters of Tolerance for Ethics Failure*, 73 J. HIGHER EDUC. 461,476–77 (2002) (citing others that faculty accuse administrators of intrusion on academic freedom when administrators even attempt to gather information about misconduct); THE GALLUP ORG. FOR THE OFFICE OF RESEARCH INTEGRITY, U.S. DEP'T OF HEALTH AND HUMAN SERVS., FINAL REPORT: OBSERVING AND REPORTING SUSPECTED MISCONDUCT IN BIOMEDICAL RESEARCH 14–16, 40 (2006) (revised April 2008) (referencing a survey of 2,212 National Institutes of Health researchers found that 164 scientists reported 201 incidents of misconduct such as falsification, fabrication, or plagiarism; estimating also that thirty-six percent of suspected misconduct incidents not

name of academic freedom, can undermine deterrence and protect unethical actors and behaviors. Yet, such people are prepared to compromise academic freedom by preventing constructive engagement with industry and placing other limits on informed judgment and decision-making. Such opposition suggests an irreconcilable paradox in which academic freedom seems more important than appropriately punishing unethical behavior but not as important as efforts to manage the circumstances that might give rise to unethical behavior in the first place.

Valiantly pursuing appropriate ethical standards and institutional integrity is worthwhile for its own sake, but there is another important benefit to a balanced program. Managing these matters properly can teach several lessons to those involved with and those who observe the program—particularly students and faculty—who will take their experiences into business and public service. Their engagement provides invaluable training in the importance of ethical behavior and facing, rather than avoiding, these difficult problems. It teaches that such dilemmas are not merely theoretical classroom exercises but have "real world" implications. And, if pursued appropriately, the struggle for balanced ethics can teach tangible, constructive approaches to resolving these sometimes perplexing problems, not just in academia but in business and public service.

Business and society need universities to find the right balance between militant, inefficient processes at one extreme, and narcissistic self-indulgence at the other.[72] In doing so, universities need to ensure that the policies and practices used

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reported to institutional officials); Scott Jaschik, *Truth and Consequences*, May 17, 2006, http://www.insidehighered.com/news/2006/05/17/churchill (explaining an investigation by the University of Colorado of alleged misconduct by Ward Churchill which came only after controversial comments about the victims of the September 11, 2001 attacks, despite long standing "knowledge" among scholars of alleged plagiarism, falsification, and fabrication; detailing further that two panel members opposed Churchill's termination to protect academic freedom); Jonathon Knight & Carol J. Auster, *Faculty Conduct: An Empirical Study of Ethical Activism*, 70 J. HIGHER EDUC. 188, 203 (1999) (explaining that administrators took no action in about sixty-one percent of complaints of misconduct such as plagiarism and sexual harassment).

72. *See, e.g.,* Harrington, *supra* note 31, at 808 (citing University of California conflict of interest policy); *see also* Thornburgh, *supra* note 44, at S38 (encourages focus on facilitating effective disclosure of potential conflicts and ensuring their transparent and consistent management).

to promote ethical behavior and remediate violations are not worse than the problems being remedied and that the perfect does not become the enemy of the good.[73] Moreover, industry needs to avoid short-sightedness through which it can be its own worst enemy by tempting the reliability and integrity of university innovation and research. It is worth struggling to get the balance right and keep it right, even as circumstances change. After all, undertaking this challenge is implicitly corollary to our nation's policies regarding advancing university innovation.[74]

III. BAYH-DOLE ACT OF 1980

There is controversy about the effectiveness of Bayh-Dole and its impact on university advancing innovation.[75] Some of the controversy revolves around principles of "causation" (whether Bayh-Dole caused an increase in patenting, licensing, and other outputs) as distinguished from the Act's "effectiveness" (the extent to which Bayh-Dole was one of many factors that may have promoted an already burgeoning university interest in advancing innovation).[76]

Bayh-Dole apologists are correct that the Act achieved its

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73. Wikiquote, http://en.wikiquote.org/wiki/Voltaire (last visited Oct. 16, 2008) (quoting VOLTAIRE, *Dramatic Art*, *in* QUESTIONS SUR L'ENCYCLOPÉDIE (1764) (literally translated as "The best is the enemy of good").

74. *See supra* note 2.

75. *See* Richard R. Nelson, *Observations on the Post-Bayh-Dole Rise of Patenting at American Universities*, 26 J. TECH. TRANSFER 13, 13–14 (2001) (citing the widespread impression that increases in university technology transfer attributable to the Bayh-Dole Act but explanation more complex); Scott Shane, *Encouraging University Entrepreneurship? The Effect of the Bayh-Dole Act on University Patenting in the United States,* 19 J. BUS. VENTURING 127, 128 (2004); *see also* MOWERY ET AL., *supra* note 19, at 7; David C. Mowery, *The Bayh-Dole Act and High Technology Entrepreneurship in U.S. Universities: Chicken, Egg, or Something Else?, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 39, 41 (Gary Libecap ed., 2005) (noting that the emphasis on Bayh-Dole as prompting university and industry collaboration ignores history stretching back to early twentieth century); Strandburg, *supra* note 49, at 94 ("clear evidence . . . that patenting at universities has increased drastically over the past 30 years, but less clear evidence linking the increased patenting to the Bayh-Dole Act itself"); Strandburg, *supra* note 49, at 103 (referring to Professors Eisengerg and Rai's extensive work on the potential adverse effects of Bayh-Dole); Boettiger & Bennett, *supra* note 10, at 262; Boettiger & Bennett, *supra* note 16, at 320.

76. *See, e.g.*, Boettiger & Bennett, *supra* note 16, at 320.

primary objective. It has helped smooth the commercialization process by imposing consistency among federal agencies in the United States about how they treat intellectual property generated from federally funded research.[77] Some point to the Act and claim success or even victory based on statistics about the growth in the number of technology transfer offices at universities,[78] the increasing numbers of licenses and other university transactions, increased revenue from those transactions, and even more start-up companies emerging from university innovations.[79]

Unfortunately, many of the technology transfer offices that began to proliferate after Bayh-Dole seem to have emerged without adequate consideration about how the offices fit within and in service to the academic mission, the numerous intellectual property strategies available in addition to patenting and licensing, the financial and personnel resources necessary to operate such offices most effectively, and the Act's other purposes. Instead, many university leaders and their advisers, including many from the legal profession, seem to have focused technology transfer offices and university policies and behaviors on commercializing research outcomes with particular emphasis on generating revenue through patenting and licensing,[80] with a further focus on pursuing the rare

77. Boettiger & Bennett, *supra* note 1010, at 278; Ritchie de Larena, *supra* note 10, at 1437.

78. The Association of University Technology Managers reports that twenty-seven universities had technology transfer offices and programs before 1983. Between 1983 and 1999, approximately one hundred and twenty universities started programs, and about fifteen more were added between 2000 and 2006. During the same time parameters, hospitals and research institutions added six (pre-1983), between nineteen and twenty-five (1983-1999), and five technology transfer offices (2000–2006), respectively. AUTM, U.S. LICENSING SURVEY, FY 2005 SURVEY SUMMARY 16–17 (Dana Bostrom & Robert Tieckelmann eds., 2007), *available at* http://www.autm.net/events/File/US_LS_05Final(1).pdf [hereinafter AUTM 2005]; AUTM, U.S. LICENSING SURVEY, FY 2006 SURVEY SUMMARY 14–15 (Dana Bostrom & Robert Tieckelmann eds., 2007), *available at* http://www.autm.net/events/file/AUTM_06_US%20LSS_FNL.pdf [hereinafter AUTM 2006].

79. Chester G. Moore, *Killing the Bayh-Dole Act's Golden Goose*, 8 TUL. J. TECH. & INTELL. PROP. 151, 155–56 (2006); Gary Pulsinelli, *Share and Share Alike: Increasing Access to Government-Funded Inventions Under the Bayh-Dole Act*, 7 MINN. J. L. SCI. & TECH. 393, 410 (2006).

80. Markman et al., *supra* note 11, at 250–51, 253–54, 257; Boettiger & Bennett, *supra* note 10, at 273–74 (noting that university focus on goal of income has in part shaped function of technology transfer system); Boettiger & Bennett, *supra* note 10, at 280 (suggesting that having income as a primary

financial home run.[81]

If university leaders are going to limit the charge of technology transfer offices to patenting and licensing or research outcomes with revenue potential, the university should have other means by which they are implementing the balance of Bayh-Dole's mandates. Restricting innovation efforts in this way facilitates being overly focused on patenting and revenue to the detriment of other, potentially more useful strategies and lost opportunities for other non- or low revenue innovations. Although commercialization should not be abandoned or ignored, it is only part of one of the seven purposes Congress expressed in the Act.[82]

At some institutions, inadequate consideration has also been given to the increasing complexity of relationships, opportunities, and strategies associated with advancing innovations.[83] As a result, many technology transfer offices are under-staffed, under-resourced, and under-supported.[84]

These circumstances further impact how technology transfer offices fulfill responsibilities that relate to intellectual property rights, valuation, risk assessments, licensing strategies, and otherwise. They also can affect how researchers view advancing innovation and how they relate to those

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goal led universities to "develop isolated programs and . . . overprotect inventions with unproven commercial value"); Ritchie de Larena, *supra* note 10, at 1381; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 21 (referencing the "misalignment of incentive systems" and encouraging that universities more appropriately link outputs to incentives); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 35 (technology transfer personnel should be assessed on their value added or volume of products or knowledge moved instead of revenue generated and Federal agencies and universities should provide incentives for "industry participation, entrepreneurship activities and fostering State and local involvement").

81. Ritchie de Larena, *supra* note 10, at 1381–82 (constant lottery effect); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 28 (encouraging universities to approach advancing innovation with a "volume model" rather than a "home run" or income model).

82. *See* Bayh-Dole Act of 1980 § 200, Pub. L. No. 96-517, 94 Stat. 3015 (codified as amended at 35 U.S.C. §§ 200, 202(a), 202(c)(1), 202(c)(7)(B) (2000)) (explaining that among the purposes of the Bayh-Dole Act are "to promote the commercialization and public availability"); *see also supra* note 7 for the Act's purposes quoted in their entirety.

83. Bagley, *supra* note 51 at, 262–63; Ritchie de Larena, *supra* note 10, at 1412 (citations omitted); *see* Markman et al., *supra* note 11, at 261 (noting disparities in sophistication and success of the 128 technology transfer offices in the study).

84. WASHBURN, *supra* note 47, at 230.

responsible for helping them do so. Finally, researchers can infer from these indicators whether university leaders view cooperation with advancing innovation efforts as important.

Congress intended Bayh-Dole to facilitate the usefulness of federally funded university research and innovation, and it stated a desire that university leaders implement it with a hunger for more than just revenue. Instead, university technology transfer office mission statements overwhelmingly emphasize licensing for royalties and intellectual property protection and management.[85] Frequently lacking has been an emphasis on (and sometimes even recognition of) Bayh-Dole's corollary goals of promoting the "utilization of inventions arising from federally supported research and development" and "the public availability of inventions made in the United States," which seems to encourage an emphasis on "deal flow density rather than volume."[86]

Taking their lead from mission statements and in an era of management theories such as total quality management, dashboards, benchmarking, six sigma, and other purported success measures of the 1980s and 1990s, many universities began using linear standards of measure to demonstrate their compliance with federal policy under Bayh-Dole and their federal grants.[87] Those measures predictably have resulted in counting: disclosures, patent applications, patents, start-ups,

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85. Markman et al., *supra* note 11, at 253–54. In a sample of 128 university technology transfer office mission statements, the authors found that they mentioned licensing for royalties 78.72% of the time and intellectual property protection and management 75.18% of the time. These mission statements mentioned the public good 54.61% of the time to finish in fifth place. *Id.*

86. Bayh-Dole Act, 35 U.S.C. § 200; *see* Crow, *supra*_note 13, at 24 (explaining Arizona State University's strategic objectives for advancing innovation and expounding further that "in other words, to maximize the number of investions and discoveries actually moved into use, instead of trying to maximize near-term income from fewer and bigger deals"); WASHBURN, *supra* note 47, at 146 ("[Universities] have no duty to return value to shareholders, and their principal obligation under the Bayh-Dole Act is to promote utilization, not to maximize financial returns. . .") (quoting National Institutes of Health 1998 working group report) (alteration in original); Ritchie de Larena, *supra* note 10, at 1377 (objectives of Bayh-Dole have not been fully achieved); Ritchie de Larena, *supra* note 10, at 1385 (objectives of Act to promote technology transfer through licensing, not to enrich universities) (quotation omitted).

87. *See, e.g.*, Schacht, 33528, *supra* note 2, at 3 (noting that increased federal funds for basic research were expected to yield "concomitant" increases in new products and processes but "this linear concept is no longer considered valid").

and of course royalties and other revenues.[88] While these standards serve certain purposes, they do not fully measure results or effectiveness against the broader purposes of Bayh-Dole.[89] Unfortunately, this approach to measurement contributed to university personnel focusing too intently on the patent-license model, which narrowed the entire vision for university innovation.[90]

To some degree, how universities have operated under Bayh-Dole might be analogized to people who tend to look at advancing innovation through a particular window in a room with a full circle, panoramic view of forests, meadows, beaches, and mountains, depending on the window. Even if the view through any particular window is good, it is not the only window in the room. There are other views—other windows—that contribute to the overall view from the room with the other windows enhancing appreciation of the beauty. Failing or refusing to take advantage of the views offered from other windows denies potential by denying information and alternatives; it also can lead to a distorted reality reminiscent of Plato's Allegory of the Cave.[91]

The biggest problems with Bayh-Dole have nothing to do with the underlying Act itself. Instead, the problems seem to

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88. *See* Siegel Study, *supra* note 29, at 33–34; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 23.

89. *See* Siegel Study, *supra* note 29, at 33 ("There are several difficulties with the output data."); Robert E. Litan et al., *Commercializing University Innovations: A Better Way* 3–4 (Nat'l Bureau of Econ. Research, Working Paper No. O18, M13, 033, 034, 038, 2007), *available at* http://www.kauffman.org/pdf/NBER_0407.pdf ("while many of the university TTOs met their narrow mandate by channeling university-generated inventions into generating revenue for the university, the broader and more fundamental goal of the original Bayh-Dole Act remains elusive—to maximize the potential for university-based inventions to result in commercialized new products and innovations.").

90. *Id.* at 8–9 ("Measuring university success in spawning innovation solely by licensing or patenting activities, therefore, almost certainly masks the importance of these other means of knowledge diffusion."); Siegel Study, *supra* note 29, at 34, tbl.6 ("Other respondents noted that TTOs are . . . too concerned with the legal aspects of licensing.").

91. VII PLATO, THE REPUBLIC 514*a*-17*a* (Allan Bloom trans., Basic Books, 1968). For an academic discussion of a few of the alternative and complementary approaches to advancing university innovation, see Litan et al., *supra* note 89, at 11–16 (among the strategies discussed are patenting, multiple volume approaches, faculty free agency, regional alliances, internet-based approaches, and faculty loyalty); *see also* Boettiger & Bennett, *supra* note 10, at 279 & n.71 (patent-licensing channel is one of many avenues).

arise from the perceptions that existed, and in some institutions still exist, that revenue is the objective and measuring revenue-related activities in the name of complying with Bayh-Dole is the same as or better than measuring impact, outcomes, and results. Also contributing to problems may be perceptions that doing something is good enough, when the true objective is doing more or better. Unfortunately, many have sought to pursue the Act's purposes as technical functions rather than as a component of an overall entrepreneurial culture.[92]

Another problem facing those engaged in advancing university innovations is that, contrary to some perceptions, Bayh-Dole did not solve (and was not intended to solve) many of the problems that researchers, administrators, and industry have been complaining about since long before Bayh-Dole passed in 1980.[93] Nearly three decades later, the following problems remain and, in some cases, have become even greater impediments to the effective and efficient exploitation of university innovations:

the high cost of patent management;

the "infrequent and unpredictable" occurrence of the "home run" innovation;

the need for close relationships with faculty;

the impact on academic freedom, research integrity, and conflicts of interest;

maintaining strong, appropriate relationships with the community;

problems associated with balancing revenues with other university expectations for its research and technology transfer endeavors; and

the expense in time and money, stress, and anxiety associated with negotiating licenses, assignments, use rights, royalties, license fees, indemnification, representations,

92. Coffman et al., *supra* note 2, at 3; *cf.* Megan Ristau Baca, Note, *Barriers to Innovation: Intellectual Property Transaction Costs in Scientific Collaboration*, 2006 DUKE L. & TECH. REV. 4, 14 (2006), http://www.law.duke.edu/journals/dltr/articles/pdf/2006dltr0004.pdf ("[the Bayh-Dole Act] provides a somewhat perverse incentive to privatize at a very early stage of research . . . .").

93. WASHBURN, *supra* note 47, at 33 ("Many of the fundamental tensions that continue to pervade higher education today . . . first surfaced in the nineteenth century."); Ritchie de Larena, *supra* note 10, at 1403 ("Problems with university management of federal funds predate passage of the Bayh-Dole Act.").

warranties, covenants and other terms.[94]

To some degree these barriers originate from the persistent complaint that the numerous participants do not know or understand each other's work environments, procedures, terminologies, rewards, constraints, etc.[95] However, and at the risk of giving industry a free pass, the barriers also may reflect the university's approach to vision, policies, and behavior and the lack of consistency among them and with federal policy.

IV. ALIGNING VISION WITH POLICIES AND BEHAVIOR AND WITH THE OBJECTIVES OF BAYH-DOLE AND FEDERAL POLICY

Some universities successfully deploy a broad-based, holistic approach to advance their innovations and fulfill their responsibilities under Bayh-Dole, as recipients of federal grant dollars, and to society generally. They frequently have an awareness of themselves that informs their policies and guides their behavior. Some of these universities and their efforts pre-date Bayh-Dole, and there is much that can be learned from them, including their continuous efforts to react to, influence, and benefit from frequently changing laws, court cases, administrative policies, technology, knowledge, infrastructure, personnel, etc.

Universities with quality reputations for advancing innovation—for instance, Stanford, University of California-Berkeley, Massachusetts Institute of Technology ("MIT"), and Wisconsin's WARF ("Wisconsin Alumni Research Foundation")— have unique and sometimes polar opposite approaches to advancing innovation. Each has developed different models and approaches customized to its unique priorities and circumstances. Their models work for them because they have either evolved over time in conjunction with their research prominence and cultures, or they have been

94. *See* MOWERY ET AL., *supra* note 19, at 58, 72.

95. One of the most significant problems in the licensing process is that the participants do not know or understand each others' work environments, procedures, terminology, rewards, constraints, etc. SCHACHT, 33527, *supra* note 7, at 3; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 3 and 33 (barriers to university-industry collaboration and innovation include "misalignment of cultures, management structures, and goals; as well as differences in the policies that apply to IP, proprietary information, and publication").

thoughtfully and strategically developed to take advantage of strengths and compensate for weaknesses.[96] Likely, it is a combination of both. However, trying to import Stanford's, WARF's, or MIT's model will likely fail because—at the risk of stating the obvious—there is no single, universal way for a university to advance its innovations; there is no "silver bullet" and what works in one ecosystem may not work under different circumstances.[97]

That being said, there are certain common themes to be derived from others' efforts. The discussion that follows is based on lessons learned from at least eleven studies involving a total of 128 different universities (many of which participated in several studies),[98] independent research and interviews, and

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96. *Cf.* Carl J. Schramm, *Making the Turn: Entrepreneurial Capitalism and Its European Promise,* 72 VITAL SPEECHES OF THE DAY, 480, 486 (2006) (encouraging countries to learn from each other but to develop tailored policies).

97. *Id.* at 482 ("Danger, or at least disappointment, awaits those who attempt singular policy solutions."); Mark L. Gordon, *University Controlled or Owned Technology: The State of Commercialization and Recommendations*, 30 J.C. & U.L. 641, 658 (2004) ("there is no one optimal structure for programs of this type."); TORNATZKY ET AL., *supra* note 2, at 9 (noting that these relationships have pluralistic and individually tailored approaches that consider internal and external cultures, customs, and experiences); NILSSON ET AL., *supra* note 35, at 7, 12 (changing a single factor such as ownership of intellectual property is not likely to be a "magic bullet" but must address a number of mechanisms collectively); NILSSON ET AL., *supra* note 35, at 22 ("There is no such thing as a single US model, but an array of different combinational elements.") (quotation omitted); LAMBERT & BUTLER, *supra* note 1, at 60 ("there is no a one-size-fits-all approach to governance."); MOWERY ET AL., *supra* note 19, at 176 ("these . . .studies reveal great heterogeneity within even a small sample of technologies."); PALMINTERA, *supra* note 2, at viii ("a successful practice in one environment may not be a successful practice in another since resources, cultures, environments and priorities vary from university to university, community to community, and state to state."); Andrew Nelson & Thomas Byers, *Organizational Modularity and Intra-University Relationships Between Entrepreneurship Education and Technology Transfer in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 275, 303 (Gary Libecap ed., 2005) (approaches to technology transfer are context dependent); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 4, 33, 37 (there is no "one-size-fits-all" approach or "ideal structure" for successful university-industry relationships).

98. Excluding Markman et al.'s study of 128 university technology transfer offices and Siegel's study of 113, the remaining nine studies analyzed forty-four universities. Coffman et al., *supra* note 2, at 4–7 (Cornell University); Gordon, *supra* note 97, at 650–56 (University of Wisconsin-Madison,Wisconsin, Stanford University, University of Illinois, University of Notre Dame, Massachusetts Institute of Technology, University of Cambridge); Harrington, *supra* note 31, at 800 & n.103 (University of North

experience negotiating with and on behalf of universities.

Three common characteristics seem to emerge about universities that successfully advance their innovations. First, these universities know themselves—who they are and who they want to be. Adjuncts to this self-awareness are understandings of the realities of revenue potential and risk allocation. Universities build their vision and culture on this knowledge and awareness. In addition, these universities implement policies and pursue behavior consistent with and in furtherance of their informed vision and desired culture.

A. KNOW YOURSELF

Many factors shape university efforts to advance their innovation: leadership, personnel, resources (financial and otherwise), policies, procedures, vision, laws and regulations—in other words, an entire ecosystem. As with other ecosystems, the components and their relative influence vary from institution to institution. Consequently, it is critical that each institution know itself so that it may best assess the appropriate strategies to pursue and the cultural, personnel,

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Carolina system, University of Massachusetts-Amherst, University of Missouri-Columbia, University of California system, University of Illinois system, Miami University (of Ohio), New York University, Harvard University, Yale University, Duke University); Markman et al., *supra* note 11, at 260 (128 universities); Nelson, *supra* note 75, at 14 (Stanford University, University of California system, and Columbia University); NILSSON ET AL., *supra* note 35, at 65, 72 (University of Pennsylvania, University of North Carolina-Chapel Hill); PALMINTERA, *supra* note 2, at 21 (Carnegie Mellon University, Georgia Tech, Massachusetts Institute of Technology, Purdue University, Stanford University, University of California-San Diego, University of Pennsylvania, University of Wisconsin-Madison, Washington University in St. Louis); PAYTAS, ET AL., *supra* note 2, at 35–94 (University of Michigan, Wright State University (Dayton), New Mexico State, University, Lehigh University (Allentown), West Virginia University, Virginia Tech, University of Northern Iowa (Cedar Falls), Florida State University); Siegel Study, *supra* note 29, at 16 (113 universities); Jerry G. Thursby & Marie C. Thursby, *Pros and Cons of Faculty Participation in Licensing, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 187, 198–99 (Gary C. Libecap ed., 2005) (Cornell University, Massachusetts Institute of Technology, University of Pennsylvania, Purdue University, Texas A&M University, University of Wisconsin-Madison); TORNATZKY ET AL., *supra* note 2, at 3 (Carnegie Mellon University, Georgia Tech, North Carolina State, University, Ohio State University, Pennsylvania State University, Purdue University, Stanford University, Texas A&M University, University of Wisconsin, Virginia Tech, University of California-San Diego, University of Utah).

and other changes it needs to make for success. In particular, universities with strong reputations for advancing their innovations know their research strengths and capacity, and they recognize the role of technology transfer in fulfilling the university's overall mission.

1. Quality Research

As former president of Harvard University Derek Bok, Anna Nilsson and her colleagues from the Swedish Institute for Growth Policy Studies, and others have recognized, the university builds its framework for advancing innovation on the quality of the underlying research being done.[99] Without high quality research and outcomes to feed the pipeline, nothing else matters in this area.[100] Quality research can exist without effective advancing innovation—as is often the actual case—but effective, credible advancing innovation (or even the technology transfer subset) cannot exist without quality research.

Two of the most important drivers of quality research are the credentials and quality of the researchers.[101] The researchers' reputations for integrity also can be as important as the substantive methodology, results, or assessments. Although not a legitimate excuse for universities to tolerate bureaucracy, industry is likely to put up with some level of

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99. NILSSON ET AL., *supra* note 35, at 7; BOK, *supra* note 31, at 106 ("Research universities are rarely, if ever, any better than their faculties."); PALMINTERA, *supra* note 2, at ix ("Excellent university technology transfer is built on excellent research."); Thursby & Thursby, *supra* note 98, at 192 (without faculty there would be no inventions to license).

100. See WASHBURN, *supra* note 47, at 187–88 ("The university can be a driving force if it's a great center for science—not if it's a great center for technology transfer. Technology transfer is . . . a secondary objective at best, probably even a third-level objective. Anybody that moves it to a higher-level objective than that is foolhardy. Because they will corrupt the university for sure.") (quoting Michael Crow, formerly of Columbia University's Office of Technology Transfer and current President of the Arizona State University) (emphasis omitted) (alteration in original).

101. *Id.* at 186 ("[T]he faculty that have been the most successful commercially are the best scientists that we have. Not, you know, among the best, but *the* best—those who've made the most fundamental research breakthroughs.") (quoting Michael Crow, formerly of Columbia University Office of Technology Transfer and current President of Arizona State University); Nelson, *supra* note 75, at 3 (noting that all three of the universities studied—Stanford, California, and Columbia—"place a very high premium on the scientific reputation of their faculty. The research that is done there, and the faculty that is selected and tenured, reflect these criteria . . .").

inefficiency and bureaucracy to work with the right, reputable researchers. Therefore, to a large degree, the path to "enlightenment"—at least in this field—begins with identifying and assessing the strengths of the research being conducted and recruiting needs to attract and retain new personnel, facilities, and other resources to more fully develop research potential.

2. A Vision That Drives Behavior

Armed with an understanding of research priorities and potential, successful universities know and understand what they want from their advancing innovation programs.[102] Is the goal money, service to society, fulfillment of fundamental teaching and research missions, keeping a given professor happy, or something else entirely? How does the institution view advancing innovation—as something technical and procedural or as something organizational and cultural?[103] The answers to these and other questions and the process by which the questions are answered frequently influence, if not dictate, policies and behavior, staffing decisions, allocation of resources, and priorities—all of which in turn influence whether a university is maximizing its innovative potential.[104]

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102. NILSSON ET AL., *supra* note 35, at 49 (explaining that without clarity of purpose, universities cannot structure activities in a way most suitable for achieving goals, including in allocating resources, technological emphasis, modes of transfer, information flow, organizational design, and human resources strategies); BOK, *supra* note 31, at 6 ("[A] university must have a clear sense of the values needed to pursue its goals with a high degree of quality and integrity. When the values become blurred and begin to lose their hold, the urge to make money quickly spreads throughout the institution."); Siegel & Phan, *supra* note 35, at 3 (noting that university leaders should consider technology transfer from a strategic perspective, driven by long term goals); Siegel & Phan, *supra* note 35, at 29 (saying that strategic approach to technology transfer includes establishing institutional goals and priorities, allocation of resources, organizational design and structure, human resource management practices, and reward systems); Brett M. Frischmann, *Commercializing University Research Systems in Economic Perspective: A View from the Demand Side, in* UNIVERSITY ENTREPRENEURSHIP AND TECHNOLOGY TRANSFER: PROCESS, DESIGN, AND INTELLECTUAL PROPERTY 155, 178–80, 182 (Gary Libecap ed., 2005) (noting that each university must determine its own ideology and mission, including how to proceed based on the university's objectives for science and research systems determined after careful evaluation of the immediate context, giving consideration to their role in society and how they compare with other institutions and social contexts).

103. *See* Coffman et al., *supra* note 2, at 3.

104. MOWERY ET AL., *supra* note 19, at 189 ("It is important that university

Some people look for answers to these questions in university or department vision, mission, or goal statements. The presence of appropriate words can be useful as an objective statement of priority, as are statements by university leadership in speeches and articles. For instance, Mary Sue Coleman, Ph.D., the President of the University of Michigan, offers one admirable perspective to explain why her institution participates in technology transfer:

> Many people are often confused about why we are interested in technology commercialization, in nurturing startup companies, and in facilitating more patents and license agreements. It is not about the promise of future revenues that might be generated from this activity. . . . It is not about the money. Technology transfer must serve our core mission: sharing ideas and innovations in the service of society's well-being.[105]

The right words in the right places, however, are not enough. As in other areas of life, words alone can have little meaning, and they become a liability if they are not accurately and consistently reflected in policies and behavior.[106]

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administrators recognize that technology transfer and licensing are components of and subsidiary to their central institutional missions of education and research. . . [and that] university policies must be consistent with this understanding as well."); PALMINTERA, *supra* note 2, at x (detailing that an entrepreneurial culture is "perhaps the strongest and most pervasive influence on [university] technology transfer and commercialization performance" as evidenced by implicit and/or explicit rewards and incentives for faculty and hiring practices that favor industry and entrepreneurial experience).

105. W. Mark Crowell, *A Message From the President*, *in* AUTM, U.S. LICENSING SURVEY: FY 2004 (Ashley J. Stevens et al. eds., 2005), *available at* http://www.immagic.com/eLibrary/ARCHIVES/GENERAL/AUTM_US/A051216S.pdf [hereinafter AUTM 2004] (message from AUTM's then-president, Mark Crowell) (quoting University of Michigan President Mary Sue Coleman, Ph.D. during 2005 AUTM Annual Meeting) (internal paragraph structure omitted); *see also* SCHACHT, 32076, *supra* note 2, at 27 ("[I]t should not be overlooked that university inventions, arising, as most of them do, from basic research, have led to many products which have or exhibit the capability of saving lives or of improving the lives, safety and health of the citizens of the United States and around the world. In that context their contribution to society is immeasurable.") (quoting Howard Bremer, patent counsel to Wisconsin Alumni Research Foundation from 1960–1988) (citation omitted).

106. *See* Edward Soule, *Managing Ethical Performance in Organizations: Insights from the Corporate World,* 74 CLEV. CLINIC J. MED. (SUPP.) S73, S75 (2007) (asserting that calls for ethical conduct are only as good as the culture in which they operate and amount to little more than cheerleading without systematic management of ethical performance); Ehringhuas et al., *supra* note 70, at S77-S78 (citing example of Paul O'Neill who, upon becoming chief executive officer of Alcoa, identified worker safety as a priority and then terminated a highly ranked superstar who failed to report an injury within 24

Inconsistency can damage an institution's credibility and reputation. Pronouncements about advancing innovation being an institutional priority bespeak hypocrisy when not matched by dedication of appropriate resources and the consistent implementation of policies and behaviors,[107] which ultimately evidences the priority given advancing innovation.[108]

When there is alignment, the reputation, culture and results can be powerful and persuasive.[109] Of course, obtaining and maintaining such alignment is hard work and takes time.[110] The understanding of and vision for how advancing innovation fits the university mission must include patience, tolerance for a certain amount of ambiguity, and no expectation of short-term, quick fixes[111] One goal must be to implement

hours of its occurrence as required by the safety rules); TORNATZKY, ET AL., *supra* note 2, at 18–20.

107. Siegel & Phan, *supra* note 35, at 3 (considering technology transfer from a strategic perspective implies providing sufficient resources to achieve the objectives); *see also* SIEGEL STUDY, *supra* note 29, at 33 (conveying that researchers report that rigid, cumbersome and unclear policies impede technology transfer).

108. Patrick Jones & Stephen O'Neil, *Can the TTO Manage its own Disintermediation?*, KAUFFMAN THOUGHTBOOK 2007, at 166, 166 (2007) (the mission of technology transfer offices is frequently subject to misalignment, which results in increased attention to commercial innovations and money resulting in overprotecting other things).

109. While an appropriate vision consistent with behaviors can contribute greatly to efforts to advance university innovation, many in the field struggle with administrations that either do not realize the importance of the need for vision or for advancing innovation at all. If that is the case, there are several ways to try to elicit vision from the administration and, maybe even more importantly, influence what that vision might be. Among these are to ask questions and, in putting the questions in context, making sure that the administration understands that multiple options and approaches exist. They may believe that there is only one vision—money. As is made more clear later, there is not much money (relatively) in technology transfer, and the money that is made usually results from a convergence of fortuitous circumstances and a supportive ecosystem. Second, the benefits of looking beyond the primary sources of money can be material, but they flow from a vision, policies and behavior that recognize the non-monetary benefits of advancing innovation, such as better educational experiences for students, the ability to attract high quality researchers for faculty, and an enhanced reputation for success.

110. PRESIDENT'S COUNCIL 2003 , *supra* note 1, at 10 (introducing a successful commercialization program requires considerable time of ten years or greater).

111. NILSSON ET AL., *supra* note 35, at 7 ("complexity . . . demands a strategic plan with a long-term view."); *see also* PALMINTERA, *supra* note 2, at xi; PRESIDENT'S COUNCIL 2003, *supra* note 1, at 9 (commercialization tools

vision with policies and behaviors—including performance measures, negotiating strategies, allocation of resources, etc.—that appropriately convey the promise of advancing university innovation as a priority in the university's pursuit of its entire mission, not just revenue.

3. Understanding Financial and Revenue Realities

In the scheme of things, there is not much money to be gained from advancing innovation.[112] Of course, when people see that universities have spawned Google, Yahoo, Gatorade, vitamin D, Lycos, Genentech and other financial blockbusters, many involved expect more innovations to yield similar returns.[113] This has the unfortunate effect of imposing unrealistic expectations on technology transfer offices and placing undue emphasis on money, which then also contributes to the one-window view and linear, old economy performance measures discussed above.[114] Such attribution also encourages

need to allow flexibility in a "rapidly changing environment"); Boettiger & Bennett, *supra* note 10, at 273 (maturing a portfolio of university intellectual property can take years); Boettiger & Bennett, *supra* note 10, at 274, 279 (long-term commitment of time and money).

112. *See* BOK, *supra* note 24, at 77; *see also* NILSSON ET AL., *supra* note 35, at 11 (discouraging university participation based on a profit motive: "it is risky and few universities profit from it") (citing Thursby & Thursby, *supra* note 98); Behfar Bastani et al., *Technology Transfer in Nanotechnology: Licensing Intellectual Property from Universities to Industry*, 1 NANOTECH. L. & BUS. 166, 167 (2004) ("In general, income from licensing is fairly small in comparison to a university's total budget, or even in comparison to a university's sponsored research budget."); LAMBERT & BUTLER, *supra* note 1, at 51; MOWERY ET AL., *supra* note 19, at 6; *cf.* Philip A. Pizzo, *Fostering Innovation Without Compromising Integrity*, 74 CLEV. CLINIC J. MED. (SUPP.) S10, S11 (2007) (reporting that the number of patents that have a huge yield is very low; they get all the attention, but there are hundreds if not thousands that fail or basically go nowhere); Siepmann, *supra* note 1, at 235; Ritchie de Larena, *supra* note 10, at 1431.

113. SCHRAMM, *supra* note 26, at 138 (noting "that many schools have unrealistic perceptions of the economic importance of their faculties' research"); *see also* MOWERY ET AL., *supra* note 19, at 84; BOK, *supra* note 31, at 77; Libecap, *supra* note 34 at xii (citing Mowery about unrealistic expectations universities have about licensing revenue).

114. *See* Markman et al., *supra* note 11, at 251 ("Many universities instruct their [technology transfer offices] to focus primarily on developing their royalty stream."); Markman et al., *supra* note 11, at 253 ("the expressed purpose of most [technology transfer offices] is to generate rents from scientific discovery . . . ."); Boettiger & Bennett, *supra* note 10, at 273 (explaining that university focus on income generation has in part shaped the functioning of technology transfer in the United States); Boettiger & Bennett, *supra* note 10, at 280 (noting that performance metrics based on revenue and numbers distort the decision-making process of technology transfer staff); Arti K. Rai &

a tendency to forget (at best) or ignore that these breakthroughs resulted from an entire innovation ecosystem, and the problem is exacerbated by companies, investors, and politicians that also expect "home runs."

According to a 2004 study by the Association of University Technology Managers, the most recent of its studies to present this data, only about one-third of participating universities (66/187) had one or more licenses that produced more than $1 million in income in 2004.[115] Less than two percent of participating universities (3/187) had ten or more licenses that produced $1 million in income in 2004.[116] According to research by two noted authorities on technology transfer—Marie Thursby, Ph.D., who holds the Hal and John Smith Chair in Entrepreneurship at the Georgia Institute of Technology and is executive director of the University's TI:GER® program discussed later, and Jerry Thursby, who holds the Ernest Scheller, Jr. Chair in Innovation, Entrepreneurship, and Commercialization at Georgia Tech—only forty percent of disclosures lead to licenses, and fewer than half of those generate any income.[117] They also found that, on average, the top five income generating licenses were responsible for about seventy-six percent of total licensing income.[118]

It is simply not possible or realistic to consistently expect that the university can predict such "home runs," a complaint/reality that predates passage of the Bayh-Dole Act. This does not mean that such revenue is not worth pursuing. This is, after all, real money and it provides real opportunities, even if amounts at a given university may not rise to the level of materiality in the typical research university's budget.

Rebecca S. Eisenberg, *Bayh-Dole Reform and the Progress of Biomedicine*, 66 LAW & CONTEMP. PROBS. 289, 306 (2003) (asserting that technology transfer office personnel "see their primary job as bringing in licensing revenue," an important criteria by which their performance is assessed); Carl Schramm, Accelerating Technology Transfer and Commercialization, Address to the Intellectual Property Commercialization and Research Spinouts Conference 4 (Nov. 4, 2004).

115. AUTM 2004, *supra* note 105, at 26.

116. *Id.* Very few universities make money from commercialization. *See* WASHBURN, *supra* note 47, at 169; Bagley, *supra* note 51, at 234; Nelson, *supra* note 75, at 17 (citing the myth that universities can expect a lot of money from patenting and licensing).

117. Thursby & Thursby, *supra* note 98, at 190.

118. *Id.*

Some might suggest that universities should focus on trying to identify and pursue their top five revenue generating innovations. If the sole goal is money, they might be right, but chasing elusive financial "home runs" risk losing what could be important opportunities for "base hits" that advance human welfare and generate profit in smaller increments, but potentially larger aggregates. Even worse, research results that could be the equivalent of human welfare "home runs" gather cobwebs. Keeping monetary gains in perspective helps universities prioritize better and operate more consistently with federal policy.[119] It also reduces the risk of criticism that overall university missions are managed by venture capitalists. Monetary results should be pursued under the right circumstances and as part of an overall strategy—rather than as the strategy.[120]

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119. See, e.g., BOK, *supra* note 31, at 141; Siegel & Phan, *supra* note 35, at 30 (citing the idea of managing licensing portfolio as a set of options, not individual wagers on "winner-takes-all" projects); Strandburg, *supra* note 49, at 97 (noting that it is impossible to predict which research will lead to important, or even revolutionary, advances, ensuring that they occur depends on having a broad portfolio of research investments); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 28 (encouraging a volume model instead of a "home run" or income model to approach negotiation of technology rights); Crow, *supra* note 13, at 24 (explaining that a strategic objective Arizona State University for its advancing innovation efforts is to focus on "deal flow density rather than revenue" and in "the number of investions and discoveries actually moved into use, instated of trying to maximize near term income from fewer, bigger deals").

120. *See* WASHBURN, *supra* note 47, at 156 ("More and more, our nation's leading universities are behaving in ways that suggest money is what ultimately guides their decision making."). In dealing with for profit enterprises, it is arguably mandated by law that tax exempt universities elicit at least fair market value from for profit enterprises in order to protect against allegations of private benefit and/or that they are serving other than charitable purposes. *See* Gordon, *supra* note 97, at 664–65; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 72 (universities must operate within the parameters of Federal and State rules, including "non-profit tax rules").

In September 2008, the Internal Revenue Service sent a "Compliance Questionnaire" to approximately 400 colleges and universities in the United States. In the Questionnaire, among other things, the IRS asks for information about university policies regarding transactions with related organizations and revenue generated from royalties, exclusive use contracts, commercial research, patents, copyrights and trade names or trade secrets. *See* Internal Revenue Service, *Compliance Questionnaire Colleges and Universities*, Form 14018, 6, 11–19 (Sep. 2008), *available at* http://www.irs.gov/pub/irs-tege/sample_cucp_questionnaire.pdf.

4. Risk Allocation and Failure Rates

Universities that successfully advance their innovations understand the extent to which industry takes risks, too. Often, university innovations are at a stage of development where there is a high degree of technical and, especially, market uncertainty.[121] As a result, firms and investors frequently need to expend more time and money conducting research and testing.[122] In one of her reports for Congress, Schacht estimates that research accounts for only twenty-five percent of the expense associated with commercializing a new good or service.[123] In another, she reports that $1 of academic innovation requires about $10,000 of private capital to bring the innovation to market.[124] Presumably, the university has proven the concept or theory, but others frequently must advance the concept or theory toward marketable stages.[125]

It is possible that these additional expenditures could be lost. After all, not every idea is a good idea, and good ideas are not always marketable at a given time.[126] Unless a pure

121. NILSSON ET AL., *supra* note 35, at 16; *see also* MOWERY ET AL., *supra* note 19, at 165, 167; Thursby & Thursby, *supra* note 98, at 190 (only seven percent of licensed technologies ready for practical or commercial use); *id.* at 204 (university research years away from potential revenue); Bagley, *supra* note 51, at 247, 250, 264 (university inventions disclosed at an very early stage with uncertain commercial potential and uncertain viability); Nelson, *supra* note 75, at 15–16 (uses for embryonic inventions are too wide, gains are too uncertain, and path to practical use is long and poorly mapped). *But see* Markman et al., *supra* note 11, at 250–54 (seventy-two percent of surveyed technology transfer offices use licensing for cash as their principal strategy where technologies are at the prototype stage for which the market has been identified).

122. *See, e.g.*, MOWERY ET AL., *supra* note 19, at 168; Siegel, *supra* note 30, at 123; Pulsinelli, *supra* note 79, at 412 (development costs typically greatly exceeding research costs).

123. SCHACHT, 33527, *supra* note 1, at 3; s*ee also* SCHACHT, 32076, *supra* note 2, at 4 ("Studies indicate that research funding accounts for approximately one-quarter of the costs associated with brining a new product to market.").

124. SCHACHT, 32076, *supra* note 2, at 4.

125. *See* Schramm, *supra* note 114, at 4.

126. A case in point is the example of portable, rapid anthrax detection and Midwest Research Institute in Kansas City, Missouri ("MRI"). MRI developed technology to efficiently detect airborne anthrax particles. While this seemed like a good idea, it was not marketable at the time of development. Decades after development, but only a few years ago, terrorists used the mail to contaminate facilities with anthrax. Suddenly, a dormant good idea became marketable and MRI responded quickly to make the technology available. This

human welfare approach is worth the financial cost—and it may not be for most for-profit enterprises—business is most often looking for opportunities to recapture its investment and then some. These are market realities, and they understandably encumber thinking in a market context. However, this thinking should not be used to excuse failure to pursue the non-economic benefits of university research, particularly when there is a growing trend of private foundations, wealthy individuals, and social enterprises focusing on maximizing broader potential and benefits.[127]

In their survey of entrepreneurs and business, Siegel and his colleagues report that the most frequent complaint from entrepreneurs is the university's lack of understanding of the business,[128] which could include its risks, needs, and cultures. Of course, Siegel also points out that the most frequent complaint from researchers, university administrators, and technology transfer personnel was that industry did not understand university culture, needs, and risks.[129]

While the university does take some limited risks, it can dramatically enhance negotiations and relationships when the university and its personnel understand the nature of the risks business is taking, including the high degree of market failures for even good ideas. This understanding should influence the university's vision and expectations, and it should inform behavior, including the terms of transfer documents associated with valuation and pricing, intellectual property strategies, and allocating liability.

5. Personnel

Universities with reputations for advancing their innovations also seem to have the right personnel with the right skills in the right positions, whether as researchers, administrators, or advancing innovation professionals.[130] For

type of convergence does not always occur but being prepared for its possibilities can be both smart and worthwhile. Telephone interview with Dr. James Spigarelli, President & Chief Executive Officer, Midwest Research Inst. (Oct. 27, 2009); Telephone interview with Jeanie Latz, former Gen. Counsel & Corp. Sec'y, Midwest Research Inst. (Oct. 9, 2006).

127. See discussion *infra* note 166 and accompanying text.

128. Siegel, *supra* note 30, at 118 (tbl.2); SIEGEL STUDY, *supra* note 29, at 31.

129. Siegel, *supra* note 30, at 118 (tbl.2).

130. Siegel & Phan, *supra* note 35, at 2 (asserting that technology transfer effectiveness ultimately depends on competencies of the people involved—

instance, universities must be wary of turning excellent researchers into only half-way decent entrepreneurs,[131] and in doing so possibly sacrificing quality innovation in pursuit of mediocre business.

Such universities also actively pursue "cross-pollination" and "bundling" among researchers and institutions and across fields and boundaries with the expectation and result that innovation is more likely to occur with interdisciplinary programs than in the silos that normally exist.[132] For instance, Stanford University has a program jointly run by the engineering and medical schools that forms teams of four from among their recent graduates.[133] These teams then immerse themselves in Stanford's hospital.[134] After two months, they are expected to make three hundred suggestions for improvement either in the practice of medicine or in administration.[135] Teams of medical personnel or engineers alone, without the benefit of the "cross pollination," may not be likely to find three hundred suggestions and the quality of the suggestions would likely be lower.

Georgia Tech established an interdisciplinary program it calls TI:GER—Technical Innovation: Generating Economic Results.[136] In this program, Georgia Tech places Ph.D. students in science and engineering on teams with MBA and law students.[137] The goals of the program are to graduate technically proficient science and engineering Ph.D.s who have a multidisciplinary perspective, to produce thesis research of scientific merit and market relevance, and to expose MBA and

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scientists, entrepreneurs, technology transfer personnel, administration—and their incentives to engage in entrepreneurial activity).

131. *See* NILSSON ET AL., *supra* note 35, at 12 (universities' primary tasks are research and education).

132. *See id.* at 50; Libecap, *supra* note 34, at xviii (citing the Stanford experience to demonstrate the importance of integrating interdisciplinary programs); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 34 (one experience common to the successful university-industry partnerships studied was the "cross fertilization of individuals with experience in government, academic, or industrial sectors"); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 37–63 (discussing various university-industry and industry-industry collaboration experiences).

133. SCHRAMM, *supra* note 26, at 84.

134. *Id.*

135. *Id.*

136. Libecap, *supra* note 34, at xvii.

137. Thursby, *supra* note 1, at 212.

law students to the challenges that arise in fundamental research and commercialization.[138] As these students pursue careers in managing research and development, intellectual property law, or leadership in industry or at universities, they should be better equipped to engage and pursue technology transfer, hopefully contributing to more effective and more efficient relationships and processes.

As for personnel responsible for advancing the innovations, much has been written theorizing about the types of people who are effective in those roles. Relevant studies approach the issue based on surveys of people from business, administration, researchers, and technology transfer office personnel. Even though based on subjective reporting, there seems to be a certain amount of reasonable advice that can be extrapolated from the research.[139]

Reminiscent of Barbási's research cited earlier, European researchers identify the critical skill for technology transfer personnel as one of "building bridges" between university researchers and business.[140] Others, such as Siegel and his colleagues, have similarly identified networking skills as critical and have characterized the role as "boundary spanners."[141] A related sub-specialty, if you will, is the role of recognizing opportunities or at least building connections and networks to serve this fundamental entrepreneurial prerequisite.[142]

In order to do this, those in advancing innovation must simultaneously earn and build trust from the researchers and from those in business[143]—a significant but surmountable challenge even with the sometimes competing and even mutually exclusive philosophies and perspectives of each. However, it can be done, and there are several ways to accomplish it. Among those are by regular interactions, demonstrated efforts to understand perspectives, tangible attempts to pursue outcomes that motivate, and appropriate

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138. *Id.* at 217.

139. *See infra* notes 140—146.

140. CREST REPORT, *supra* note 50, at 65, 76.

141. Siegel, *supra* note 30, at 122; Siegel, *supra* note 31, at 121; *see also* Siegel & Phan, *supra* note 35, at 4, 34.

142. Siegel, *supra* note 31, at 121; Schramm, *supra* note 114, at 6.

143. *See* GOVERNMENT-UNIVERSITY-INDUSTRY RESEARCH ROUNDTABLE, NAT'L ACAD. OF SCI. ET AL., OVERCOMING BARRIERS TO COLLABORATIVE RESEARCH: REPORT OF A WORKSHOP 2 (1999).

respect for and implementation of ethical behavior. Some have suggested that earning trust may be the most important factor for technology transfer personnel, but trust is much less a single characteristic than a coalescing of the right combination of character, skill, experience, and networks. Trust also takes time to build and maintain, unless the people in or hired to the positions have already earned the requisite levels and types of trust by reputation.

The European researchers also identify a core set of skills that they suggest should be taught in formal courses. The skills run a significant gamut and include business development, intellectual property management, negotiating, networking, contracting, coaching, finance, and others.[144] While it may be impossible to find any one person who possesses these diverse skills at a high performance level, certainly the right team of people could be found with complementary skills.

The Muenster University of Applied Sciences in Germany took a different route. They appointed a marketing expert as director of technology transfer rather than a lawyer, entrepreneur, engineer, bureaucrat, or scientist.[145] At the time of his appointment, he was the only European director whose core competency was marketing.[146]

There is an even more fundamental issue as it relates to personnel for the advancing innovation office. These offices and efforts should have an appropriate number of qualified people and sufficient resources. Frequently, technology transfer offices are understaffed and their resources (and jobs) are based on the revenue they generate. Both factors motivate personnel to focus excessively on money, including devoting scarce attention only to those innovations that are most likely to raise the most revenue. In the process, one-size-fits-all approaches become normal, potentially life altering innovations can be ignored, and technology transfer can be perceived as anathema to, instead of complementary of, academia. Actual staffing and resources for the technology transfer office say more about the university administration's philosophy regarding innovation and federal policy than any words that

144. CREST REPORT, *supra* note 50, at 65, 76.

145. Interview with Dr. Thomas Baaken, Dir. of Tech. Transfer, Muenster Univ. of Applied Sciences, in F.R.G., (Oct. 20, 2006).

146. *Id.*

might be used.

The right people with the right skills and perspectives can make or break a transaction, and they can build or inhibit trust as the foundation of relationships. There is only so much that the quality of the research or the university's reputation can do to compensate for poorly placed and/or under-resourced personnel. Universities should ensure that their policies and behavior allow them to recruit and retain the right people for their vision of advancing innovation, including appropriate measures of and rewards for successfully implementing the university's vision and federal policy.

V. POLICIES AND BEHAVIOR CONSISTENT WITH AND DERIVED FROM A VISION FOR ADVANCING INNOVATION

One of the biggest challenges all universities face in their efforts to advance innovation is sculpting a culture of innovation using the right policies and behaviors and changing those that are counterproductive or outdated.[147] Even Stanford, which is frequently mentioned as among the best, had to recognize that its policies and behavior may have been inhibiting efforts to advance its innovations.[148] Two anecdotes from my experience as a practicing lawyer illustrate some of the typical policy and behavioral challenges. Of course, not all of my experiences have been inappropriately difficult or unnecessarily time consuming or expensive, and positive experiences also are instructive in assessing university policies and behaviors.

A client wanted to donate a worthwhile innovation to a university. It took nearly nine months for my client to give that innovation away as we worked through four different

147. Gordon, *supra* note 97, at 672 ("[T]he challenge for each university is to structure the most beneficial commercialization program for its organization, balancing its needs and its mission of benefiting the public and its students with its technology commercialization efforts."); *see* Crow, *supra* note 13, at 26 (Arizona State University has "instituted a number of institutional policies that promote entrepreneurship and make it easy to move ideas into action, consistent with the policies mentioned earlier relating to intellectual property commercialization. Conversely, policies that discourage entrepreneurial behavior are minimized").

148. See TORNATZKY, *supra* note 2, at 160 (citing a 1995 faculty survey that reported "Stanford is perceived as one of the worst American universities to deal with, especially on the topic of ownership/patent status of intellectual property").

offices at the university–legal, technology transfer, risk management, and administration. We struggled through inconsistent positions among them with regard to such considerations as liability exposure, export control compliance, and representations and warranties. We also had to deal with the university's desire that my client indemnify the university for its activities in exploiting the innovation. With regard to the last point, my client accepted responsibility for the originality of and non-infringement by the underlying intellectual property, but the university wanted my client to indemnify it for liability the university might incur as a direct result of actions by the university or within its control. We finally completed the transaction, but the journey was more arduous, time consuming, and expensive than it needed to be.

In another instance, a client wanted to license software from a university's for-profit subsidiary. My client decided to forgo alternative—possibly better—providers specifically in part to help this entity gain credibility and traction in the marketplace. Among other problems, the university wanted my client to indemnify it if its software was deemed infringing. In addition, the university wanted to control and use all of the data collected using the software. Other negotiating challenges included what my client believed to be the entity's inflated view of the software's financial value and a lack of understanding of (or desire to learn about) essential legally mandated restrictions peculiar to my client's business. Although we eventually negotiated the issues to a mutually agreeable end, everyone involved agreed that the process was more convoluted and difficult than it needed to be.

In both of the above circumstances, the universities involved prided themselves on their vision for advancing innovation, but their policies and behavior inhibited implementing that vision. Additionally, and as often seems to be the case, the above universities appeared to approach the transactions without regard to the specific circumstances, and they instead seemed to blindly apply generally held positions, even though inapplicable.

A. POLICIES AND BEHAVIOR: LEGAL TOPICS

Among the legal topics that most impact the intersection of

university policy and behavior are conflicts of interest,[149] intellectual property, liability, representations and warranties, export controls, and compliance with laws and regulations of the United States concerning tax exempt or governmental status. Too frequently, universities may try to adopt one-size-fits-all approaches to these multi-faceted and frequently complex legal issues. Such behavior often may involve wholesale adaptations of something that is perceived to have worked for a different institution, or they may be broad-based extrapolations of something that happened to work in a unique, but unrelated, situation. This can result in blanket practices such as "never" indemnifying, "always" requiring that the university be fully indemnified (even for its own actions), and "never" making certain representations regarding originality or non-infringement.

Blanket practices usually seem to be implemented with the expectation or hope that they will streamline licensing, result in greater efficiency, and ultimately save money. Unfortunately, such practices, when applied rigidly and without analysis or exception, can interfere with licensing and increase the time and financial cost. They can also be a disincentive to begin negotiations because of their effect in shifting risk and responsibility away from the university, even in cases when the university is in the best (and sometimes only) position to control the risk. Such generic approaches and one-sided practices usually run counter to and undermine federal policy and a purported vision that extols the virtues of advancing innovation.

When inflexible practices are accompanied by a corresponding expectation that licensees also will pay high fees or make other compromises, the result can be disequilibrium, time consuming and costly negotiations, stagnating innovations, and frequently higher transaction and research costs.[150] Protecting the university is important, but so is allowing society to benefit from the innovations harbored in university labs. This is not to say that universities should be

149. See discussion *supra* notes 35–65 and accompanying text.

150. See Baca, *supra* note 92, at *1 (transaction costs increase research costs and slow the pace of scientific progress); *id.* at *20, *24, *26 (protracted negotiations can be costly and time consuming and can cause the loss of research windows and grant opportunities and delays in progress and real science); Rai & Eisenberg, *supra* note 114, at 297 (transaction costs can mount quickly); Pulsinelli, *supra* note 79, at 431–32 (costs and delays in agreeing to license have an adverse impact on the research enterprise).

reckless or that they should not protect themselves; however, advancing innovation efforts would be significantly enhanced with legal practices and behavior that better balance university responsibility and fees with the actual benefits and allocation of risk, and the ability to manage that risk. Striking the right balance along the continuum is worth the struggle, particularly in the areas of intellectual property and liability.[151]

1. Intellectual Property

The universities best at advancing innovation understand that there are a variety of options when addressing intellectual property issues regarding ownership, exclusivity, use rights, and other matters.[152] They also understand that different innovations may warrant different strategies; different stages of development afford varying degrees of leverage; and different market demands, risks, and opportunities may justify different tactics.[153]

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151. *See, e.g.,* PALMINTERA, *supra* note 29, at ii (Massachusetts Institute of Technology, Stanford University, Carnegie Mellon University, Georgia Institute of Technology appear to have found their balance and lead to attract star faculty and innovative minded students and faculty); Carl J. Schramm, *Five Universities You Can Do Business With*, INC. MAGAZINE, Feb. 2006, at 23 (identifying California Institute of Technology, University of California–Berkeley, Stanford University, Massachusetts Institute of Technology, and University of Wisconsin as having found the right balance); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 28 (identifying intellectual property negotiations as a "significant barrier and continual challenge" even among "extremely successful partnerships").

152. Among questions that might be considered in helping to address ownership of sponsored research are the following: (1) Who proposed the project/collaboration in the first place?; (2) Who is paying for it?; (3) Who is taking the lead to organize the research? Design it? Conduct it?; (4) Is the research mission critical for university? For industry?; (5) Whose facilities? Equipment? Personnel?; (6) Will the research or reporting require access to privileged information of materials?; (7) How does the Project relate to prior work of industry? University? Researcher?; (8) What are the various applications/uses? What is the commercial potential? What fields of use? Are there specific geographic areas that might be more or less interested?; (9) How does ownership by one party restrict the other? Is there a "knock out effect"?; and (10) Are there other legal issues, such as contractual limitations, exempt organizations/IRS issues, etc.? *See*, CREST REPORT, *supra* note 50, at 49–53.

153. MOWERY ET AL., *supra* note 19, at 6 ("[P]rocesses of knowledge exchange and technology transfer are complex, and the channels through which these processes operate most effectively differ significantly among different fields of technology."); MOWERY ET AL., *supra* note 19, at 34 ("[T]he evidence from expert surveys and other sources [] highlights the substantial differences among industries and fields of research and innovation."); Arti K.

Much has been written about inherent differences in the desirability of patenting, and thereby more vigorously protecting, the underlying intellectual property of biomedical and pharmaceutical innovations when compared with advances in information technology and communication, technologies where time to market is more critical.[154] Much of that discussion has occurred in the context of trying to document the

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Rai et al., *University Software Ownership: Technology Transfer or Business As Usual?* 28 (Duke Law Sch. Sci., Tech. and Innovation Research Paper Series, Research Paper No. 20, 2007), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=996456 ("Ideally, we would want decisions about whether to patent publicly-funded academic research to be based not only on the private marginal costs of patent acquisition but on whether a patent is needed to facilitate commercialization in a specific case, which is likely to vary across inventions and fields."); J. Strother Moore et al., Computing Research Ass'n., Best Practices Memo: University-Industry Sponsored Research Agreements 1 (Sept. 2003), http://www.cra.org/reports/ip/bestpractices.pdf (distinguishing information technology from biomedical, pharmaceutical, and agricultural advances such that universities can introduce significant barriers to cooperation by forcing information technology into a standard patent-centric form); *see also* SCHACHT, 30320, *supra* note 2, at 3 (distinguishing pharmaceutical and biochemical areas where patents can be important from electronics, where they may not be); Siegel & Phan, *supra* note 35, at 29 (emphasizing stage of development and field of emphasis); Boettiger & Bennett, *supra* note 10, at 279 (patent-licensing is one channel and should not be the limited focus of technology transfer efforts); Markman et al., *supra* note 11, at 249–55; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 28 (industry is critical of some universities "for employing the same technology transfer approach for pharmaceutical- and biotechnology-related discoveries as they use for information technology inventions").

154. *See* Mowery, *supra* note 30, at 3–4, 22–25; MOWERY ET AL., *supra* note 19, at 178 (identifying the need to recognize differences among academic disciplines or research areas with economically significant incentives in biomedical research, but not as great a need in electronics and other areas), 190–91 ("It is important for university research administrators to adjust their intellectual property policies to accommodate these intersectoral differences" which requires "pursuit of a broader and more flexible set of objectives through patenting and licensing policies, rather than focusing solely on licensing revenues."); Moore et al., Computing Research Association, *supra* note 137, at 1–2; MOWERY ET AL., *supra* note 19, at 154, 178, 190–91 (explaining need to recognize differences among academic disciplines or research areas with economically significant incentives in biomedical research but not as much in electronics and other areas; "It is important for university research administrators to adjust their intellectual property policies to accommodate these intersectoral differences" which requires "pursuit of a broader, more flexible set of objectives through patenting and licensing policies, rather than focusing solely on licensing revenues."); *see also* SCHACHT, 32076, *supra* note 2, at 4; PRESIDENT'S COUNCIL 2003, *supra* note 1, at 11 (value of intellectual property to various industries is "highly variable"); SCHACHT, 32076, *supra* note 2, at 4; Rai & Eisenberg, *supra* note 114, at 302–03 (citations omitted).

effectiveness of the Bayh-Dole Act. However, it should not be Bayh-Dole that drives universities to patent; it should be the specific circumstances surrounding the intellectual property in question. Bayh-Dole gives the freedom to patent and exploit, but it does not purport to replace judgment about when or whether to patent or how to exploit. Patenting may be the best approach when it is essential to preserve a legitimate competitive advantage, to exploit the invention for substantial commercial or social gains or both, or to arm against infringement claims.

Patenting may not be appropriate in other contexts or sometimes even if the above mentioned factors are present. Patenting is not the only intellectual property option available for protecting or exploiting university innovations. The precise strategies deployed should depend on any number of factors, including the following:

a. the likely commercial and non-commercial applications for the innovation, including uses for further research and exploration;[155]

b. the possible commercial and social value;

c. the extent to which further development is necessary to realize potential;

d. the presence of a unique market demand or opportunity and even if a present or likely future market exists at all;

e. the likely business interests, including ease to replicate and time to market;[156]

f. the existing and likely competition, if any;

g. whether protection inhibits or enhances basic research;[157]

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155. *See also* PRESIDENT'S COUNCIL 2003, *supra* note 1, at 16 (highlighting the need to balance protecting commercial value against access to tools for further research and exploration).

156. *See* PRESIDENT'S COUNCIL 2003, *supra* note 1, at 11.

157. Rai & Eisenberg, *supra* note 114, at 289, 296 (warning that patents on early stage discoveries can be broad and permit holders to control subsequent research); Baca, *supra* note 92, at *20, *24, *26.

> [L]ongstanding norms call for relatively unfettered access to fundamental knowledge developed by prior researchers. . . . The tradition of open science has eroded considerably over the past quarter century as proprietary claims have reached farther upstream from end products to cover fundamental discoveries that provide the knowledge base for future product development.

Rai & Eisenberg, *supra* note 114, at 289.

h. the effective commercial life for the innovation;[158] and

i. the social and other costs associated with a preservationist approach.

These factors help universities determine whether to patent, to assign, to license, or to make the innovation freely available as open source, through publication, or otherwise. If the university pursues licensing, it then must determine whether the license should be exclusive or non-exclusive, limited in time or perpetual, limited in geography, limited to a particular use, or if the terms and restrictions should vary depending on whether the use is for commercial, academic research, or charitable purposes.[159]

Part of the difficulty is that none of these decision factors happens in a vacuum, and it is unrealistic and even counterproductive to follow the adage—as economists are fond of saying—"all else being equal." Frequently, there are real risks, expenses, and opportunity costs that also must be considered. All too often, there also are limited financial and human resources available within the university to provide the depth of analysis of these factors to make the most informed decision. These realities become even starker when university leadership and its advisors over-emphasize monetary gains and engender an over-developed fear of giving away too much. As a result, it sometimes becomes too easy to default to a "one-size-fits-all" approach to intellectual property, even unintentionally.[160]

Uniform approaches can help ensure that the university pursues core positions on various contractual, economic, and liability matters. Templates and forms can expedite transactions if the underlying terms are generally reasonable

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158. Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, *in* 2 INNOVATION POLICY AND THE ECONOMY 51, 66 (Adam B. Jaffe et al. eds., 2002) ("What matters is the *effective* life, that is, the time until the noninfringing substitute appears. The effective life is determined by patent *scope* or *leading breadth*, which is interpreted as the minimum quality improvement that avoids infringement.") (citation omitted).

159. MOWERY ET AL., *supra* note 19, at 191; Moore et al., *supra* note 127, at 2.

160. Siegel Study, *supra* note 29, at 33–35 (indentifying that the industry reports dissatisfaction with university technology transfer office marketing and negotiation skills and lack of business skills and expertise, both of which, they complain, cause university to focus too narrowly on a small set of technical areas, be too concerned about legal aspects of licensing, and cause universities to exercise intellectual property rights too aggressively given the circumstances).

and context-appropriate. They also can facilitate clarity and consistency; after all, not every transaction needs every detail to be negotiated. Creative commons, science commons, varieties of open source, and other resources can help in those circumstances. Unfortunately, uniform strategies for intellectual property can over-protect the underlying innovation, and they can instill a false sense of entrenchment that delays the university in changing core positions when circumstances dictate.[161] Agreement may eventually be reached, but frequently those involved are frustrated and have devoted too much time and money.

That perspective can lead to difficult, unwieldy, and time consuming negotiations that increase costs for all involved, another complaint that has survived from the pre-Bayh-Dole era. Those costs are part of the calculus that business and other potential "buyers" (including other universities) will use to determine if it is worthwhile to pursue a relationship.[162] Ironically, transaction costs that are beyond what is reasonable can undermine the university's revenue motive because of expenses incurred and opportunities lost.

Consequently, the one-size-fits-all approach too frequently leads to negative situations, each of which may undermine advancing innovation efforts generally.[163] First, researchers may circumvent the university and directly approach acquirers,

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161. *See* BOK, *supra* note 31, at 141; SIEGEL STUDY, *supra* note 29, at 29–30; Siegel, *supra* note 30, at 123; WASHBURN, *supra* note 47, at 191 ("[Universities] 'want the big payoff . . . but they don't want to take any risk.'") (quoting Thomas Burger, vice president for corporate development at Genta Inc.); WASHBURN, *supra* note 47, at 193 ("[U]niversities . . . overestimat[e] the commercial value of their inventions, and [take an] aggressive stance in licensing negotiations.") (citing 1991 GUIRR study on industry perspectives).

162. NILSSON ET AL., *supra* note 35, at 15–17; *see also* MOWERY ET AL., *supra* note 19, at 84 (noting the high cost of patent management and its effect on potential financial return); PRESIDENT'S COUNCIL 2003, *supra* note 1, at 11, 13 (cautioning institutions to beware of time and costs incurred to execute agreements, as they are "not inconsequential" and need to be reduced).

163. *E.g.*,Gallini & Scotchmer, *supra* note 158, at 67 (recognizing the debate that intellectual property policies "can stifle innovation and slow progress") (citation omitted) (1990); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 1, 4, 33 ("there is no 'one-size-fits-all' approach for creating a successful research partnership" or for "strengthening connection points between parties"). *But see* Crow, *supra* note 13 at 24 ("Arizona State University has developed licensing templates and master sponsored research agreements, which can reduce the need to negotiate over terms and conditions").

licensees, or investors. Furthermore, they might even leave the university. Second, innovations may stagnate. Finally, the university may implement inflexible policies and behaviors that sometimes may work, sometimes inhibit, and frequently are not conducive to advancing innovation. In the first instance, the university may lose out on opportunities. In the latter two instances, both the university and society lose the benefits that might be available from the research outcomes. None of these results are desirable.

Some advocate that all university innovations should be given away freely and without reservation or charge. In certain instances, this or other open system approaches may be appropriate, and they should be considered as a legitimate strategic alternative for select innovations, particularly when open collaborations and open innovation systems present opportunities to solve research challenges and more rapidly advance innovations to address problems in society.[164] However, as a blanket, wholesale, one-size-fits-all approach to all university advances, the nearly 100-year-old observations of Frank Gardner Cotrell, one of the visionaries and founders of The Research Corporation, remains valid: innovations that could better the human condition have not reached fruition when given away freely because there is no financial return to be expected to justify the additional expenditure and risk.[165] Importantly, increased engagement by private foundations, wealthy individuals, and public charities dedicated to research in certain areas, including through grants, program related investments, and direct investment, could result in more significant opportunities and capital needed for development and distribution.[166]

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164. *See* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 3. Among the factors that a university might consider in making innovations freely available are the nature of the innovation and the nature of the proposed use. For instance, it might be appropriate to make certain software, technology, and even pharmaceutical or biomedical advances broadly available in order to encourage and speed up their further development and commercialization. Also, it might be appropriate to charge for certain innovations but make them freely available when used for purposes of educational or scientific research.

165. MOWERY ET AL., *supra* note 19, at 59 ("[A] number of meritorious patents given to the public absolutely freely by their inventors have never come upon the market chiefly because 'what is everybody's business is nobody's business.'") (quoting F.G. Cottrell, *The Research Corporation, an Experiment in the Public Administration of Patent Rights*, 4 J. INDUS. & ENGINEERING CHEMISTRY 864, 865 (1912)).

166. S*ee* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 1, 5 (acknowledging

As a matter of implementing federal policy, universities that succeed in advancing their innovations usually have already considered many of these alternatives, have connected with appropriate expertise, and are efficient at prioritizing and allocating resources to make the innovations as available as possible whether through patents, licenses, open source, publication, or other routes.

2. Liability, Representations and Warranties, Indemnity

Liability, indemnification, and sovereign immunity can be among the hardest and most difficult issues to address when advancing university innovations. Principles of academic freedom and the purported inability to control faculty and to provide oversight or demand accountability are regular justifications for "never" making representations or warranties about originality or non-infringement, or "always" diluting these provisions. Universities also rely on these same principles and claimed inabilities to assert that they "never" indemnify or defend even for their own behavior.[167]

Many institutions promulgate these default positions despite being in the best position to monitor researcher activities, obtain representations and warranties from the researcher, and impose meaningful remedies against the researcher in case of breach. Moreover, universities frequently receive additional amounts—sometimes substantial—as part of grants to cover administrative costs, some part of which could be used to monitor or supervise researchers enough to provide proper representations and warranties.[168] It can be

trend of increased involvement by private foundations funding research, particularly in medicine and healthcare); *see also* I.R.S. Priv. Ltr. Rul. 200603031 (Oct. 25, 2005), *available at* http://www.irs.gov/pub/irs-wd/0603031.pdf. A few high profile examples include the various activities and strategies of the Bill and Melinda Gates Foundation, Michael J. Fox Foundation for Parkinson's Research, Milken Family Foundation, Prostate Cancer Foundation, the Omidyar Network, Google Foundation, Faster Cures, and others.

167. *See* Ritchie de Larena, *supra* note 10, at 1405 (quoting the President of the University of Utah in 1994 as asserting that it would be "an impossible and self-defeating approach" for universities to monitor the actions and veracity of its faculty).

168. *See* Ritchie de Larena, *supra* note 10, at 1405–06 (stating that taxpayers can legitimately expect universities to "comply not only with correct font on a cover page, but also proper monitoring, including at the departmental level where fellow researchers and department chairs are most

disconcerting when a university is not willing to support its own personnel, who are presumably motivated by academic integrity, reputation, job security, future job prospects, and/or even pecuniary interest. A university suggesting that industry or a licensee university should obtain representations, warranties, and protections from the researcher are little or no comfort, especially when the licensor will not rely on the researcher in the first instance.

In essence, universities that take these types of positions seem to want the benefits of the research, frequently paid for by others, without the responsibility or risk associated with what it takes to achieve those benefits. Not only might they try to actively shift that responsibility and risk to others but they also frequently refuse to compensate the other party for their increased exposure by reducing fees or royalty rates, or altering use rights or other restrictions to better account for the shifted risk.

Ultimately, universities have an abiding interest in protecting reputations and relationships. A university with a reputation for permitting infringing material or content may suffer educational consequences because they will have difficulty attracting and retaining high quality faculty and students, and the non-economic benefits of university relationships with industry are jeopardized. They may also suffer economically, through lost tuition revenue, sponsored research opportunities, and even charitable donations, and relationships with industry and community will suffer, resulting in lost contributions.

Consequently, universities are concerned about ensuring originality, non-infringement, and other legal compliance—regardless of the circumstances.[169] Universities do have recourse when confronted with evidence of plagiarism, fraud, harassment, or any number of other behaviors that offend ethical, moral, or legal standards. Despite objections from academia based on academic freedom or lack of control or oversight, universities are able to mete out consequences when they have the will to do so.[170]

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likely to be able to vouch for their colleagues with some knowledge and confidence").

169. *See* CREST Report, *supra* note 18, at 19 (good technology transfer offices "define, secure, and document the rights to background knowledge" and "obtain written assignments from students and researchers").

170. *See* Jaschik, *supra* note 71 (academic panel found faculty member

As a practical matter, refusing to provide certain customary representations or warranties or to indemnify or defend against harm caused by their own behavior may not alter the university's exposure much. The absence of these provisions in a contract may save the university from responsibility to a licensee, but the university may still be liable directly to an injured party for infringement, tort, or otherwise where joint and several liability may be its only remaining shield. Meanwhile, the university's reputation and relationships may suffer in at least two meaningful ways: first, because it tolerated the infringing behavior or unethical research; and second, for its positions in negotiating the license and trying to shift responsibility for its behavior. In the end, the university may still be financially liable to the same degree as if its contract included the representations and warranties and/or the duties to indemnify and defend. However, its economic damages may be greater because of the damage to reputation and relationships. As a result, attempts by universities to justify intransigence on liability issues by invoking academic freedom, lack of control, or administrative costs generally are strained, except possibly for statutory mandates relating to sovereign immunity.

Principles of sovereign immunity and corresponding legislation often dictate what state universities can or cannot do in making representations, warranties and covenants, or in agreeing to indemnify or defend.

With regard to originality and non-infringement, these matters are normally addressed in representations and warranties. Absent waiver, however, sovereign immunity protects states and their subdivisions, including universities, from liability for infringing another's intellectual property rights.[171] This is not a level playing field for private universities, who must develop their negotiating strategies (including price) to consider their exposure to infringement claims by the licensee and third parties. As a result, private universities are less able to decrease pricing or demonstrate

guilty of plagiarism and other charges but divided about punishment); Knight & Austen, *supra* note 71, at 203 (about forty percent of complaints resulted in some action to redress misconduct such as plagiarism or harassment).

171. *See* Coll. Sav. Bank v. Fla. Prepaid Postsecondary Educ. Expense Bd., 527 U.S. 666 (1999); Fla. Prepaid Postsecondary Educ. Expense Bd. v. Coll. Sav. Bank, 527 U.S. 627 (1999).

flexibility in other ways because of the exposure they must account for. Public universities are freer to disregard intellectual property rights, which could make dealing with public universities more expensive for the licensees. In addition, it may be argued that the lack of consequences for infringement by state institutions decreases their motivation to appropriately monitor their researchers.

The advantages that sovereign immunity affords public universities are not limited to infringement. They may also rely on this doctrine in a products liability context. Although affording additional protections to the public university, sovereign immunity can be a disadvantage if there is reluctance to license innovations from such institutions because of the increased liability exposure to the licensee.

Compromises to sovereign immunity that would create limited exposure and reforms in liability exposure of private universities and licensees could facilitate usefulness of university innovations. For instance, setting aside sovereign immunity or permitting degrees to hold harmless agreements to allocate some risk to the university can encourage greater accountability regarding researchers and can provide some financial comfort to licensees. Additionally, the exposure could be capped except in the case of gross negligence or intentional or willful misconduct. After all, some degrees of liability exposure can impose accountability and inhibit recklessness. Similar provisions could help protect private universities that act in good faith and level the playing field for public and private institutions.

Because of the amounts of federal money involved in supporting research and its distribution without regard to the character of an institution as private or public, a federal policy that desires maximal utilization and commercialization would oppose broad application of sovereign immunity as a deterrent to proper allocation of risk and a deterrent to expedited advancement of university innovation. Reforms along these lines could provide a degree of certainty to universities and industry (and their respective insurers) that would help better quantify risk, more concretely defines potential consequences, and still ensures that injured parties are not left without recourse.

As it stands now, principles of sovereign immunity may not be negotiable in many circumstances but only to the degree to which the principles apply. Unfortunately, there have been

instances borne of misunderstanding, ignorance or desire to deceive to overstate the actual degree to which the public university is immune, including by mischaracterizing university policy (from which they may deviate) as covered by sovereign immunity (from which they may not, depending on the state). Such mischaracterizations can negatively influence the university's credibility and integrity, whether in acquiring innovations, sponsoring research, or even making donations.

In addressing these challenging issues, successful universities do not segregate them from other issues. They recognize that relationships exist among and between negotiated topics. For instance, the monetary value of the intellectual property rights being granted may be less than otherwise expected in the absence of the university's ability to provide satisfactory representations and warranties or to address liability, indemnity, and related issues. There may be other ways to creatively compensate for the increased risk that the university is shifting to the licensee or assignee, such as permitting a longer term, favoring exclusivity or loosening certain conditions associated with exclusivity, broadening the geographic scope, allowing alternative media of expression and uses, and expanding rights regarding derivative works. Unfortunately, many of these opportunities can be lost because of how universities sometimes staff negotiations.

Clarity of responsibility for decision-making on these and other legal topics can be critical, and its absence can inhibit advancing innovation efforts. As noted in one of the examples at the beginning of this section, transactions around advancing university innovations can involve multiple arms of the university with frequently disparate, unilateral views but unclear means for reconciling these views. This bureaucracy can permit people to abdicate responsibility or inhibit the ability to make decisions, absent time consuming consensus building. This behavior and competing policy perspectives can be as frustrating to the university's personnel as it is to those with whom it negotiates.

Clear authority should be vested appropriately, ideally in one person who is knowledgeable and readily accessible for negotiations, so that such person can assess the risks and benefits associated with various options and circumstances, and she or he can make legal, business, and practical decisions.

B. POLICY AND BEHAVIOR: PRACTICAL TOPICS

There are at least two practical topics that can reflect more broadly on how a university satisfies federal policy and contractual obligations to advance its innovations: disclosures and measuring efforts.

1. Disclosures

Disclosures to technology transfer offices of inventions, innovations, technologies, discoveries, etc., are the foundation of the university's advancing innovation programs. People responsible for such programs must know about the innovations available for transfer. Unfortunately, not enough innovations with commercial or other useful potential are disclosed.[172]

The following chart shows information reported to the Association of University and Technology Transfer, the affiliation group for technology transfer personnel, about researcher disclosures, new patent applications by universities, and patents issued to universities for 2004, 2005, and 2006.[173]

	2004	**2005**	**2006**
Disclosures	16,871	17,382	18,874
New Patent Applications	10,517	10,270	11,622
Patents Issued	3,680	3,278	3,255

According to a study by Jerry and Marie Thursby, sixty-four percent of faculty surveyed made no disclosures during the years studied, and about fifteen percent made disclosures in only one year within those studied.[174] Therefore, only twenty-one percent of surveyed faculty made disclosures in two or more of the years studied. It is hard to believe that there are not more innovations that should be disclosed. More should be done to encourage and facilitate such disclosures.

Universities can increase disclosures by implementing

172. See Thursby, *supra* note 1, at 214. See *infra* note 176 for a chart representing information reported to the Association of University and Technology Transfer, the affiliation group for technology transfer personnel, about researcher disclosures, new patent applications by universities, and patents issued to universities in 2004, 2005, and 2006.

174. Thursby & Thursby, *supra* note 98, at 200.

policies and pursuing behavior that motivates and removes barriers to disclosure.[175] Research suggests that scientists and researchers are motivated by professional prestige and recognition;[176] monetary rewards that lead to better equipment, facilities, support and availability for research opportunities;[177] licensing potential and money for their own personal use;[178] the propagation, dissemination, and exchange of ideas;[179] access to platforms for testing their ideas;[180] constructive changes in the curricula;[181] advances in benefits to human welfare;[182] and even enhanced job prospects for their students.[183]

It is not necessarily a novel suggestion that those involved should appeal to these motivating influences by including rewards for behavior consistent with the desired goals for

175. *See* Siegel & Phan, *supra* note 35, at 3, 25; PRESIDENT'S COUNCIL 2008, *supra* note 12, at 21 ("Misalignment of incentive systems and a lack of transparency can create barriers for university-private sector research partnerships."); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 21 (universities should connect outputs to incentive systems for faculty, technology transfer office personnel and administrators); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 34 (encouraging flexibility in tenure processes to acknowledge the importance of and commitment of time to university-industry relationships); PRESIDENT'S COUNCIL 2008, *supra* note 12, at 35 (tenure decisions often fail to recognize critical factors other than publications and Federal grant money; technology transfer personnel should be assessed on their value added or volume of products or knowledge moved instead of revenue generated; and recognizing need for Federal agencies and universities to provide incentives for "industry participation, entrepreneurship activities and fostering State and local involvement").

176. SIEGEL STUDY, *supra* note 22, at 10–11, 49 tbl.1; *see also* TORNATZKY ET AL., *supra* note 19, at 19 (stating that universities with external economic and industry partners often reward faculty involvement with these partners with acknowledgment and accolades).

177. Siegel, *supra* note 30, at 130; NILSSON ET AL., *supra* note 35, at 43; SIEGEL STUDY, *supra* note 29, at 31; *see also* Strandburg, *supra* note 49, at 95 (at the margin, scientists more likely to respond to opportunities for greater scientific productivity and autonomy than wealth).

178. NILSSON ET AL., *supra* note 35, at 43; *see also* SIEGEL STUDY, *supra* note 29, at 32.

179. *See* Siegel & Phan, *supra* note 35, at 5; *see also* Siegel, *supra* note 30, at 130 (finding that technology transfer improves university scientists' research through access to the ideas of industry scientists).

180. NILSSON ET AL., *supra* note 35, at 43.

181. *See* Siegel, *supra* note 23, at 130.

182. *See* NILSSON ET AL., *supra* note 35, at 43 ("[University] researchers are more driven by research than money."); *see also id.* at 28 (noting that a factor motivating Japanese researchers is putting research to practical use to benefit society).

183. NILSSON ET AL., *supra* note 35, at 43; Libecap, *supra* note 27, at ix.

technology transfer programs. Some rewards seem fairly easy to implement, such as promoting publication and presentations,[184] adopting generous standards for sharing royalties, license fees, and equity stakes in companies,[185] or recognizing in tenure and promotion the validity of disclosures, patents and other behavior that advances technology transfer.[186] Most universities seem to implement some combination of these to varying degrees, but greater efforts are needed.

At the same time, universities should address perceived barriers to disclosure, including threats to academic integrity, concern that disclosure may take time and energy away from research, and fear that disclosure may require researchers to become enmeshed in bureaucratic, inefficient, and uncomfortable patenting, licensing and commercializing processes.[187]

In addition, when university leaders overtly focus on revenue, researchers may believe that they will not receive meaningful attention equivalent to their efforts, unless disclosing an obviously lucrative innovation. As a result, researchers may refrain from disclosing innovations that are not clear financial home runs because they believe doing so will be unlikely to matter. Those realities and perceptions can change if university behavior changes.

Incentives and disincentives for disclosure and university approaches to them can be among the best evidence of whether universities prioritize advancing their innovations and fulfilling their federal policy obligations. To some degree, game

184. *See* SIEGEL STUDY, *supra* note 29, at 10–11 (asserting that publication and conference presentations are primary motives for university scientists); *see also* TORNATZKY ET AL., *supra* note 2, at 53, 89 (citing practices of North Carolina State University and Purdue University). *But see id.* at 166 (citing practices at Stanford University).

185. *See* SIEGEL STUDY, *supra* note 29, at 32.

186. *See id. But see* Philip M. Pizzo, M.D., *Panel Discussion: Research, Innovation, and Safety: Doing the Right Thing,* 74 CLEV. CLINIC J. MED. (SUPP.) S16, S19 (2007) (asserting that aligning tenure decisions with patents "is a misuse of scholarship because it skews things in a way that misses the opportunity for fundamental discovery").

187. *See* Richard Jensen et al., *The Disclosure and Licensing of University Inventions* 2, (Nat'l Bureau of Econ. Research, Working Paper No. 9734, 2003) *available at* http://www.nber.org/papers/w9734.pdf?new_window=1; *see also* Thursby & Thursby, *supra* note 98, at 189 (discussing the failure of faculty to disclose because of possible publication delay, time required for industry research and development, and perceptions regarding the roles of academic scientists and engineers).

theorists and economists alike might persuasively contend that motivating disclosure is a matter of demonstrating that it is worthwhile and better than the next, best alternative, which might be non-disclosure, circumvention, or even departure.[188] Therefore, high performing, entrepreneurial universities must make sure (1) that incentives make disclosure worthwhile and (2) that disincentives are minimal and exist only as needed. Successfully increasing disclosures should generate enough quality content for universities to reliably account for their compliance with federal policy and the expenditure of public money. Disclosures can provide this through commercialization and pursuit of monetary, educational, humanitarian, and other benefits that flow from the entrance of quality research into the advancing innovation pipeline.

2. Measures of Success

As noted in Part II.A, universities in the United States do not operate in a purely manufacturing economy that measures success linearly.[189] It is no longer just a matter of objective inputs yielding predictable outputs. Unfortunately, many of the measures associated with technology transfer from universities have remained linear, which is unsurprising if revenue is the primary objective.[190] To evaluate advancing innovation inputs, universities look to "income" generated by sponsored research,

188. Jensen et al., *supra* note 187, at 10–11; *see also* Strandburg, *supra* note 49, at 108–09 (suggesting that disclosures occur when revenues from patenting a discovery outweigh any opportunity costs or penalties for violating norms).

189. *See supra* notes 24–26 and accompanying text; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 1-2, 7, 31 (recognizing the changing paradigm from a linear innovation pathway to a "dynamic ecosystem" that is non-linear, or less linear, more complex, and iterative).

190. As Siegel and his colleagues note business places significant value on some of the more informal paths for technology transfer. Siegel, *supra* note 30, at 127; Siegel, *supra* note 31, at 130–131; *see also* MOWERY ET AL., *supra* note 19, at 5 (discussing findings that patents and licenses are less important to industry for knowledge exchange than other channels such as publications and conference presentations); Libecap, *supra* note 27, at xi–xii ("[U]niversities influence industrial innovation through . . . interacting informally and in conferences with industry researchers . . . ."). It will help technology transfer personnel build trust with faculty and researchers if they recognize the importance of these measures and can facilitate, or at least accommodate these opportunities to the extent possible. *See supra* notes 127–130 and accompanying text.

grant activity, and disclosures.[191] To measure outputs, they frequently seem to calculate the following:

a. number of patent applications, patents, and licenses or assignments;

b. revenue generated from license fees, royalties, options, and cashed in equity;

c. new products introduced to the market; and

d. number of business start-ups begun and ongoing.

Not surprisingly, the above list contains indicators that most readily reflect that money is the goal that university leaders have for advancing innovation.[192] All of these are relevant indicators of some level of activity and effort, and the information should continue to be gathered and used appropriately. However, these measures do not most accurately reflect how universities implement federal policy or most fully account for the expenditure of tax dollars. Examining disclosure figures illustrates this point.

Using only the numbers available for fiscal year 2006, which saw about $45.4 billion in sponsored research, universities appear to have spent approximately $2.4 million in research per disclosure, $3.9 million per new patent application, and $14 million per patent.[193] However, it is

191. *See, e.g.*, AUTM 2006, *supra* note 78, at 20, 24 (reporting sponsored research dollars and disclosures).

192. See *supra* notes 112–114 and accompanying text.

193. The chart below presents data available from AUTM for 2004-2006. It also presents a financial relationship between those outputs and the amount expended within each given year rounded to the nearest dollar.

	2004	2005	2006
Disclosures	16,871	17,382	18,874
New Patent Applications	10,517	10,270	11,622
Patents Issued	3,680	3,278	3,255
Sponsored Research Dollars	$41.245 billion	$42.3 billion	$45.4 billion
Research Spending Per Disclosure (calculated)	$2,444,728	$2,433,552	$2,405,425
Research Spending Per New Patent Application (calculated)	$3,921,746	$4,118,793	$3,906,384

critical to remember that these ratios at best are only illustrative because the outputs counted in 2006 most likely arose from research dollars expended in and aggregated over multiple preceding years. We probably get closer to actual ratios by calculating outputs in 2006 as a function of expenditures in 2004 and 2005, which yields an expenditure per disclosure ratio about twice as high as the amount based on 2006 research dollars. Accurate data is not available from which to make reliable calculations or assessments of how research spending correlates to the above activities. However, the possible difference in disclosure ratios should demonstrate how deficient and unreliable this information can be as a purported measure of the outputs of technology transfer efforts.

Even considering the seemingly ubiquitous measure of licensing revenue, the relationship to spending is similarly distorted and ill-informed. Using AUTM's 2006 reported revenue as an example and unrealistically assuming that a relationship exists between 2006 revenue and research expenditures in the same year, the financial return on the taxpayer's investment appears to be about four percent.[194] Recognizing that it is more likely that expenditures in prior years seeded the revenues received in 2006, that return is reduced by half if 2006 revenue is compared against aggregated research expenditures for both 2004 and 2005.[195] As a pure financial matter, two to four percent returns are not acceptable outputs or results.

There also is a temptation to suggest that these ratios could support the statements at the beginning of this article

Research Spending Per Patent Issued (calculated)	$11,207,880	$12,904,210	$13,947,773

AUTM 2004, *supra* note 105, at 2, 15, 16, 18, 19; AUTM 2005, *supra* note 78, at 13, 22, 26, 28; AUTM 2006, *supra* note 78, at 5, 20, 24 25.

194. See AUTM 2006, *supra* note 78, at 5, 20, 38–44. To arrive at this figure, we totaled the amounts provided by the universities to AUTM for the 2006 study regarding revenue generated from their advancing innovation efforts and divided that amount by the amount spent on research. AUTM last provided a total on revenue in its 2004 survey. In that survey, AUTM reported $1.385 billion in net licensing revenue and about $41.245 billion in research expenditures. AUTM 2004, *supra* note 105 at 2, 3, 14, 24–25. Using those amounts, we can calculate a "return" of about 3.35%.

195. See AUTM 2004, *supra* note 105, at 2, 24; AUTM 2005, *supra* note 78, at 5, 22, 42–47.

that university innovation advancement efforts generally are not reaching their potential.[196] These calculations should not, however, be relied on except in concluding that they demonstrate the incompleteness of current measurements and the need for better ones. For instance, none of the traditional indicators for assessing outputs account appropriately for benefits in economic growth and advances in human welfare, such as jobs created or retained, taxes paid, efficiencies gained, lives made more comfortable, and illnesses prevented or abated.

The University of North Carolina–Chapel Hill ("UNC") developed a technology to be used as an adjunct to the AIDS vaccine.[197] Working through their start-up company and in collaboration with the University of Capetown in South Africa, UNC launched a clinical trial.[198] Although there may be high demand for the adjunct, there is little economic reward UNC can expect.[199] Using traditional measures of success, this effort by UNC might measure a "one" in licenses granted. It is unlikely to reach materiality in terms of revenue when measured against the University's annual budget. Given those realities, some might contend that it was not worth the time, energy, or effort to make this technology available under traditional measurements. UNC believed otherwise. Given the number of lives that could be improved or even saved, this innovation could be considered a "home run" under alternative performance measures.

To its credit, AUTM also recognizes limitations of data on patents, disclosures and research dollars, and desires new indicators that better assess the fruits of advancing innovation efforts.[200] John Fraser, President of AUTM when it published

196. *See supra* pp. 1–2.

197. Mark Crowell, *The Changing Face of University Technology Transfer*, *in* EWING MARION KAUFFMAN FOUNDATION, KAUFFMAN FOUNDATION THOUGHTBOOK 2005, at 107, 110 (2005).

198. *Id.*

199. *Id.*

200. *See id.* at 109 ("[T]raditional measures are problematic."); *id.* at 110 (citing AUTM discussions about developing "more important and more substantive measures"); Ben Butkus, *Questioning Licensing Revenue As Measure of Success, AUTM, Others Seek Alternatives*, BIOTECH TRANSFER WEEK (December 10, 2007), http://www.biotechtransferweek.com/issues/1_39/features/143878-1.html; s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 4, 25. 34 ("few robust measures and quantitative asessements exist" and "more robust metrics are needed to describe the actual inputs, outputs, outcomes, and impacts of the

its FY2005 study, described the AUTM board's work "to identify additional, new metrics to measure impact and outcomes of our activities."[201] Mr. Fraser also explained AUTM's interim efforts to tell more of the story by featuring success stories in its report "to more clearly illustrate the results—the benefits—of the tech transfer process."[202] Patrick Jones, Ph.D., AUTM's President upon publication of its FY2006 study, similarly reflected that "[t]he impact of technology transfer is not in mere numbers reflecting the activities of offices, but rather in the benefit to the public . . . ."[203] Dr. Jones continued that "these numbers are just a part of the actual contributions from research performed . . . ."[204]

As discussed earlier in the context of a vision that drives behavior, using linear standards as a primary measure of activity can communicate how the university and its leaders view advancing innovation and the priority, or lack thereof, that they place on doing so.[205] If advancing innovation is to serve the overall mission of the university and fulfill federal policy, additional measurements consistent with such an approach should be adopted.[206] Those measurements might

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R&D enterprise").

201. AUTM 2005, supra note 78, at 4.

202. *Id.*

203. AUTM 2006, *supra* note 78, at 4.

204. *Id.*

205. *See* Crowell, *supra* note 197, at 109–10 (explaining that a focus on dollars, or number of patents, license agreements, and disclosures can cause the university to lose sight of public benefit and economic benefit); Boettiger & Bennett, *supra* note 10, at 273 ("The focus by universities on . . . income generation has in part shaped the functioning of the U.S. technology transfer in United State system."); *id.* at 280 ("performance metrics based on revenue . . . and numbers of patents and licenses, distorts decision-making process of technology transfer TTO staff"); Markman et al., *supra* note 11, at 259 (stating that universities are pressured to show tangible returns to society); Rai & Eisenberg, *supra* note 114, at 306 (stating that technology transfer office personnel see their primary job as bringing in licensing revenue, and that it may be important in their performance assessment); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 35 (standards to evaluate performance of university researchers and make tenure decisions "often fail to recognize other critical factors" because they rely primarily on publications and Federal grants; current metrics for incentives and reward systems "lack the flexibility to optimally support university-private sector partnerships and innovation").

206. See MOWERY ET AL., *supra* note 19, at 178:

> To the extent that universities choose among these instruments carefully, and with the objective of facilitating use and

reflect the benefits of advancing innovation efforts in service to economic growth and human welfare, and might include the following:

a. number of those who use innovations that emanate from universities;

b. number of medical treatments administered;

c. number of diseases treated;

d. number of students engaged;

e. number of lives saved or improved;

f. number of jobs created or retained;

g. total economic impact,[207] including sales volume, revenue, and income and other taxes generated (and exempted because of tax status);

h. regional economic development changes, and new businesses that might emerge in support of the new technology, products, or services;

i. number and quality of social networks created, enhanced, and expanded;

j. number of new collaborations developed; and

k. amount of time involved with and total costs of licensing.

Not all of these forms of measure will be useful or even make sense for every innovation or university, and there certainly are others that could be added. The point is that there should be discussions about including less linear, non-standardized measures that will better account for resources

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commercialization rather than maximizing royalty income, patents and licenses can advance the mission of the university-industry technology transfer while maintaining the other important missions of public and private universities in the United States.

See also PRESIDENT'S COUNCIL 2003, *supra* note 1, at 11 (Stating that metrics to quantify program effectiveness are needed and "must take into account a wide range of steps in a highly complex process"); MOWERY ET AL., *supra* note 19, at 190 ("A single-minded focus on patenting and licensing as the only important or effective channels for technology transfer is unrealistic and may produce policies that limit the effectiveness of other channels that are more important . . . ."); s*ee also* PRESIDENT'S COUNCIL 2008, *supra* note 12, at 4 (advocating for metrics of technology innovation, workforce, and productivity) and 21 ("development of new technologies and creation of human capital").

207. See SCHACHT, 32076, *supra* note 2, at 16 (reporting that estimated returns to society from investment in basic research are twice those received by industry, and include increased revenues from taxes on profits, new jobs created, improved productivity, and economic growth); SCHACHT, 30320, *supra* note 2, at 10 ("[B]ringing new products, processes, and services to the marketplace can generate economic growth in the form of new jobs, [and] greater productivity . . . .").

and allow universities to encourage those positioned to advance innovations. These types of indicators may even help increase disclosures as researchers realize that their innovations have practical effects beyond money.

Finally, technology and society have changed. What previously might have been pursued as strictly proprietary (consistent with the manufacturing approach), may now more reasonably be treated as open source in certain industries and research focus areas. Although not easily subject to the traditional, linear standards of measure, open source, Creative Commons, Science Commons, and other approaches to intellectual property can be meaningful and influential. New approaches demand additional measures of performance to account for the impact of such advancements.

New approaches also may help delineate gains made against the inventory of stagnant creativity mired in laboratories, drawers, and shelves. Current standards of measure do tell us that innovation is being advanced, but they do not provide much information about whether potential is being reached or whether the university, its researchers, and society as a whole are receiving reasonably robust benefits from the fruits of federally funded university research. There may be a certain naiveté about this vision, but without considering it among the benchmarks of achievement, universities will only be able to tell whether they have increased from prior years. Beating last year's numbers may be progress, but it does not mean that federal policy has been implemented or that returns have been maximized on the tens of billions of dollars spent each year on research.[208]

VI. CONCLUSION

Far too many meaningful university innovations lie dormant and under-utilized.[209] Given the amount of money spent annually to further university research and the relatively low levels of quantitative return,[210] one can argue that this under-utilization creates enormous waste, unrealized potential, and even moral failure. Among these innovations may lie more

208. *See, e.g.*, AUTM 2006 *supra* note 78, at 5 ("Universities received $45 billion plus in R&D expenditures . . . .").

209. See *supra* note 1 and accompanying text.

210. See *supra* notes 189–191 and accompanying text.

effective ways to cure, treat, and prevent disease; ways to better conserve, exploit or replenish natural resources; technologies that allow us to better understand science; or any number of other useful discoveries. We need sustained efforts to advance university innovations as envisioned by federal policy.

Some have suggested that reversing or modifying Bayh-Dole can produce the results Congress intended.[211] Such an approach may be unworkable for practical reasons, including the need to address the fact that various other governmental and private sources also fund the same research and have their own expectations. As a policy matter, it may be better to address deficiencies elsewhere in the commercialization and utilization processes. For instance, in light of the growing number of 501(c)(3) organizations interested in medical and health care advances, it might be useful to change federal policies for some period of time to make it easier for such organizations to invest resources at intermediate stages of development.[212] The government could also offer tax incentives to for profit enterprises investing at that stage, thereby bridging the current "valley of death" to "increase economic welfare and the productivity of government R&D investment."[213] Alternative treatment of investments by 501(c)(3) and for profit organizations in enterprises building substantially on university innovations may serve similar purposes. While policy makers and others consider these and other changes, universities that have not been as successful in advancing their innovations might pursue the suggestions in this article and other strategies for more fully implementing federal policy expressed in Bayh-Dole.

Institutional transformations are hard work, take time, and involve risk. Perpetuating the status quo, however, also carries risk, including that of denying society the benefits of an unacceptably large quantity of university research and innovation. The rewards for engaging this work, taking this

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211. *See* Rai & Eisenberg, *supra* note 114, at 291 (arguing that funding agencies have a more appropriate combination of knowledge and incentives to decide intellectual property rights and that Bayh-Dole should be modified to allow them to determine when to dedicate federally funded research results to the public domain).

212. See *supra* notes 127, 166 and accompanying text for a discussion of the increasing interest of private foundations and other non-profit organizations in broadly utilizing and commercializing cures for disease.

213. Ford, *supra* note 17, at 36.

time, and accepting reasonable risks can transform economic possibilities and advance human welfare in ways we may not even be able to imagine yet. Moreover, concerns about conflicts of interest and commitment, and other ethical dilemmas do not outweigh these benefits or the federal policy mandate. They still must and can be managed in a balanced way that protects reputations and the actual as well as perceived credibility of research outcomes. As a result, we should expect more. University leaders and others in academia and industry should do more to produce and demonstrate better returns—financial and otherwise—on the investment of taxpayer money.

This can be done by ensuring that universities operate with a vision for advancing innovation that (i) complements the university's academic and research missions and (ii) is informed by the institution's research capacities and personnel, and realistic expectations about revenue potential and allocation of risk. Vision alone, however, will not produce results. Several universities have shown that results can follow when vision is implemented through corresponding policies and consistent behaviors that (i) pursue variable intellectual property strategies appropriate for the circumstances, (ii) properly allocate liability and risk, or compensate in other ways for misallocations, (iii) entice and reward researchers for their disclosures and their cooperation with the advancing innovation process, and (iv) more fully measure and explain the results of our nation's investment in university research. These responsibilities lie first and foremost with university leaders and their advisors, many of whom are from the legal profession.