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POLICY ANALYSIS:

UNIVERSITY SOCIAL RESPONSIBILITY: BALANCING ECONOMIC & SOCIETAL BENEFITS OF UNIVERSITY RESEARCH

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Executive Summary

Clark Kerr, the former President of the University of California system, believed that the modern university should act from a perspective that encompasses the multiple duties which are placed upon it by the people whose life it enters in so many ways (Kerr, 1963). This belief has led many land grant universities in the 21st century to be expected to respond to local, state, and national economic development and industrial competitiveness needs. University-industry partnerships and technology transfer programs are increasingly looked upon as a vehicle to achieve these desired objectives. This perspective existed since the time of their founding; in fact, the 1862 federal legislation that established the land grant university mandated it.

This paper traces the origins of the university-industry partnerships and technology transfer programs in American society. The historical review shows how the land grant university has enhanced its activities to fulfill its original mission and meet contemporary demands in global industries. This paper also counters arguments made by some critics that the scale and nature of these activities since the 1980s set them apart from earlier, more limited entrepreneurial endeavors. These critics assert that through these initiatives the university is being captured by corporate interests and are substantially altering the priorities of the research university. Second, this paper argues that as the relevance of the land grant university is increasingly integrated into the knowledge-based economy, the university has a responsibility to ensure that its research benefits all society. The 21st century public research university should have the leading role in promoting University Social Responsibility (USR), which closely mirrors the concept of Corporate Social Responsibility. This concept asserts that the university manages the wider social and environmental consequences of their actions, beyond the requirements of the legal and regulatory setting in which they operate. USR provides an approach to science, technology and research in which contributions to the economically disadvantaged is given value and attention. Third, a case study of UC Berkeley's Socially Responsible Licensing Program is presented as an exemplar of how land grant universities are developing a dual paradigm which maintains its mission to enhance economic prospects of society --the charge of its enabling legislation-- but also ensures that it produces scientific knowledge and outcomes that are socially robust. Finally, a set of policy recommendations are offered to guide land grant universities to more effectively engage in University Social Responsibility platforms. These include establishing a reflexive USR policy, restructuring the Technology Transfer Office (TTO) to create a double bottom-line that does not just include revenue but also social impact, and ensuring transparency in the patenting and licensing of publicly funded research.

From the time of their founding, the land grant universities were expected to contribute to the economic vitality of their states. The relationship between land grant university research and industrial innovation thus has been a long and interconnected one; in fact federal legislation that established the land grant university mandated it. The land grant university was structured through public financing from state and local sources with federal research support to provide strong incentives for university faculty and administrators to focus efforts on research activities that would yield economic and social benefits (Shapira & Youtie, 2008; Mowery & Sampat, 2004).

Today land grant universities are expected to respond to local, state, and national economic development and industrial competitiveness needs. University-industry partnerships and technology transfer offices (TTOs) are increasingly looked upon as a vehicle to achieve these desired objectives.[1] Some scholars, however, have argued that the scale and nature of these initiatives since the 1980s set them apart from earlier, more limited endeavors (Washburn,2005; Slaughter & Rhoades, 2004; Rudy & Coppin, 2007). These scholars assert that through these initiatives the university is being captured by corporate interests and are substantially altering the priorities of the research university.

The central aims of this analysis are fourfold. First, this paper will argue that university-industry partnerships and TTOs are not a new feature in American society. Although it may appear that the land grant university is changing in nature, in actuality the university is fulfilling its original mission by enhancing its activities to meet contemporary realities in global industries.[2]

Secondly, it is argued that as the relevance of the land grant university is increasingly integrated into the knowledge-based economy, the university has a responsibility to ensure that its research benefits all society.[34] The 21st century public research university should have the leading role in promoting

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[1] University Technology Transfer offices (TTOs) generally manage intellectual property (patents, inventions, software, other copyrightable works, etc.) developed at the university. These offices typically seek to transfer university technologies to the market so as to generate benefits for the University, the community and the general public (Miller & Le Boeuf, 2009).

[2] Land grant universities were selected for this study due to their founding commitment to render service directly to society. Though this paper primarily highlights land grant universities, many public universities established after the enactment of the federal Morrill Act of 1862 (see page 3) were modeled on the land grant tradition and as such, many of this paper's findings can also be applicable to those public institutions.

[3] The land grant model was principally based on the needs of 19th century industrialization.

University Social Responsibility, which closely mirrors the concept of Corporate Social Responsibility. This concept demands the university manage the wider social and environmental consequences of its actions, beyond the requirements of the legal and regulatory setting in which they operate. USR provides an approach to science, technology, and research in which contributions to the economically disadvantaged are given value and attention.

Thirdly, a case study of UC Berkeley's Socially Responsible Licensing Program is presented as an exemplar of how land grant universities are developing a dual paradigm which maintains its mission to enhance economic prospects of society --the charge of its enabling legislation-- but also ensures that it produces scientific knowledge and outcomes that are socially robust.

Finally, a set of policy recommendations are offered to guide land grant universities to more effectively engage in University Social Responsibility (USR) platforms. These include establishing a reflexive USR policy, restructuring the Technology Transfer Offices (TTO) to create a double bottom-line that does not just include revenue but also social impact, and ensuring transparency in the patenting and licensing of publicly funded research.

The Origins of the Land Grant University and Its Role In Society

Since 1862, a number of legislative acts of the U.S. Congress, state and local governments have broadened the research and mission of land grant universities to produce research for the public good that had local economic and societal benefits (Cote & Cote, 1993; Turk-Bicakci & Brint, 2005). Serving as the cornerstone of this governmental effort, the federal government first defined the mission of the land grant university through the federal Morrill Act of 1862 (herein referred to as the Morrill Act), which provided states with land to establish universities to train students in agricultural and mechanic arts to meet the

[4] In the knowledge-based economy, competitive advantage lies in knowledge-intensive industries such as information technology, biotechnology and life sciences, etc. These industries are research and development (R&D) intensive, with many of the scientific and engineering breakthroughs that advance them often occurring initially at the university-level (Shafffer & Wright, 2010; Powell & Rhoten, 2010).

needs of industry and agricultural technology. As stipulated in the statutory language, the Morrill Act enabled the creation of accessible egalitarian universities.

"Without excluding other scientific classical studies and including military tactic, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life" (7 U.S.C. § 304).

Before the Morrill Act, U.S. higher education was built on an English elitist model from the medieval era which highlighted the role of the university as accumulators of old knowledge. This model was in a function that was largely separated from the rest of society and was exemplified in Oxford and Cambridge universities, where scholars and students housed in residential colleges lived and learned apart from the public at large (Martin, 2001).[5] In contrast to this convention, the establishment of the land grant universities in the U.S. reflected the belief that American social and economic development could be best served if higher education was more integrated with society and was made broadly available to all sectors of public life. Prior to the Morrill Act, the majority of colleges and universities of the time were private or church-sponsored institutions (Shapira & Youtie, 2008; Martin, 2001).

Thus in contrast, the design of the land grant university was originally influenced by universities of the late 19th century, which sought a more active and research-intensive role for universities.[6] Newly formed universities, such as Berlin's Humboldt University pursued scientific research based on rational inquiry and experimentation. This model highly encouraged universities to assume roles in conducting research and training of students to meet industrial needs. This influence led Congress to pass the Hatch Act of 1887, which added the charge to conduct research and experimentation in the public interest to the mission of the land grant university.[7] These legislative actions by Congress established a public, federally

[5] This form of university model is commonly referred to as Mode 1.
[6] These research intensive institutions are commonly referred to as Mode 2 universities.
[7] The Hatch Act initiated federal support for research and discovery, thereby further establishing the role of government in stimulating economic growth. Most importantly, the Hatch Act directed land grant universities to establish Agricultural Experiment Stations, which sought to promote the efficient production, distribution, marketing, and use of products and research and experimentation methods that promote a prosperous agriculture industry and national economy. Another significant act of Congress, the Smith-Lever Act of 1914, resulted in Cooperative Extension Service programs being established by land grant universities, which took the findings of researchers from universities to the fields of farmers (Oklahoma State University, 2008).

assisted higher education system. While institutions of that time focused almost exclusively on philosophy and theology, the land grant university focused on broader practical education and research. This was in keeping with the view that higher education could be a major engine for socio-economic development (Shapira & Youtie, 2008; Martin, 2001; Powell & Rhoten, 2010).

While land grant universities for the early part of the 20th century followed this model, after World War II due to dramatic increases in government and industry funding for university research, they expanded their roles for both basic science and applied technology development.[8] This new funding scheme, led to the formation of the Triple Helix model, which is the contemporary model in which land grant universities operate today. Under this model, universities, local industry, and government are bound as partners in a region with a common and interconnected set of social, cultural, and economic resources. These partnerships sought to both develop human capital and capitalize on university-based research and scientific capacity to stimulate regional innovation and growth (Etzhowitz & Leydesdorff, 2000; Shapira & Youtie, 2008). Under the Triple Helix model, a knowledge network is developed, consisting of overlapping and interconnected spheres of academia, government, and industry, and with hybrid organizations, which include venture capital firms, and trade associations emerging at the interfaces. The Triple Helix, moreover, promotes tri-lateral initiatives for knowledge-based economic development among government and academic laboratories and research groups by way of strategic alliances among institutions (Etzhowitz & Leydesdorff, 2000; Powell & Grodal, 2005).[9]

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[8] Motivated by the critical wartime advances in science and engineering and justified by national defense and health needs, Congress came to favor a postwar science policy that stressed an active role for the federal government in expansion in both basic and applied research. The foundation of this strategy was outlined in Vannevar Bush's 1945 Presidential report, "Science: the Endless Frontier." At the time, Bush served as the Director of the U.S. Office of Scientific Research and Development. Bush's report was rooted in the belief that federally funded basic research and scientific training conducted by the universities would be the engine of economic progress and national development. Accordingly, this defined the research university as a public entity and scientific knowledge as a fundament al public good, with government patronage. This dynamic is often referenced as the "social contract for science" (Bush, 1945).

[9] The United States became the dominant technology-based economy after World War II and held that position for decades by accumulating a significant base of technical, physical, and organizational assets. These assets have enabled the U.S. to be the first mover in every major technology to appear in the global economy since the early 20th century, including agriculture-based technology, semiconductors, software, advanced materials, network communications, and biotechnology (Tassey, 2008). The development of these technologies has benefited from decades of government support of both scientific research and early-phase technology development. A significant component of this governmental support promoted collaborative relationships between universities and industry, particularly between academic research in emerging fields and the creation of new high-technology enterprises (Tassey, 2008; Shapira & Youtie, 2008; Mowery & Sampat, 2004).

Though land grant universities had been strong in producing research and development (R&D), as individual institutions they could not commercialize technological innovations (Etzhowitz & Leydesdorff, 2000). The Triple Helix allows industry not only to develop strategic alliances to help guide and contribute to R&D at the university-level, but it facilitates connections between university research and regional businesses to develop commercial applications of university technology and knowledge (Etzhowitz & Leydesdorff, 2000).[10] In the Triple Helix, universities become even more deeply embedded in innovation systems. The land grant university had always been an institution of knowledge, but under previous models, the university was not able to actively use knowledge to promote indigenous development and new capability in its region and beyond (Powell & Rhoten, 2010).

Government plays an interconnected role in promoting the Triple Helix model to advance regional competitiveness throughout the nation. Fearing an increasing trade deficit with emerging economies, the federal government enacted various rules and regulations to integrate market pull and technology push through new organizational mechanisms that enhances these alliances (Etzhowitz & Leydesdorff, 2000).[11] Another component of the government's response to the perceived decline in U.S. competitiveness was legislative action to strengthen Intellectual Property Regimes (IPR) and other incentives to invest in R&D. These include R&D tax credits and favorable conditions for the creation of R&D consortia. The enactment of the Bayh-Dole Act of 1980 had the most pronounced impact on the Triple Helix model, as it simplified the procedures under which U.S. universities could patent and license the results of federally funded R&D, thereby facilitating multi-institutional R&D collaboration and technology transfer (Granstrand, 2005). Moreover, federal policy encourages university technology transfer while federal mission agencies, which fund most university research, also look for economic and social returns on their

[10] In this mode, universities could efficiently develop R&D and patent and license their intellectual property to private sector entities. Thus, this process enabled them to exact royalties and licensing revenue. Prior to the passage of the Bayh-Dole Act (See page 7), universities were inefficient in the patenting/licensing of their intellectual property (several universities were also ambivalent whether they had the authority to engage in such practices). The emergence of the Triple Helix and the passage of the Bayh-Dole Act, streamlined procedures for patenting technology derived from federal research funding. It also provided a clear statutory authority for universities to engage in such activities.

[11] These included the development of the Small Business Innovation Research Program (SBIR), the Small Technology Transfer Program (STTR), the Advanced Technology Program (ATP), the Industry/University Cooperative Research Centers (IUCRC) and the Engineering Research Centers (ERC) of the National Science Foundation (Etzhowitz & Leydesdorff, 2000).

R&D investments.[12] Likewise, state governments–which operate large public university systems and fund teaching—increasingly request that their institutions foster economic development and innovation within their regions (Powell & Rhoten, 2010, Owens-Smith, Powell, 2003).

Multiple forces influence the land grant university's role in the Triple Helix. They include the underlying economic shifts from traditional, linear mass production to knowledge-based, open and more interactive innovation systems (Shapira & Youtie, 2008). Changes in organized science also further encourage university interests in expanding technology transfer. Times for discovery to application over the last four decades have been shrinking, while the scale of research in the sciences continues to grow (Tassey, 2008). [13] These shifts challenge the mission of the land grant university to remain relevant in the new knowledge-based economy. This requires the land grant university to reorganize research to address rapid and new developments in technology which require interdisciplinary collaboration to enhance educational methods to meet demands for new forms of human capital development. More importantly, it requires universities to redefine the ways in which they develop and exchange knowledge with industry and various constituencies (Shapira & Youtie, 2008; Powell & Rhoten, 2010).

In essence, under these new and contemporaneous conditions, which essentially support the global knowledge economy, land grant universities have moved away from older models of practice in which the university pushed publicly funded research out to industry toward newer models. The emergence of the Triple Helix model encourages scientists to actively collaborate with industry on publicly and privately supported research. This current model has created a dense web of affiliations between universities, governments, and commercial firms.

<u>Are the commercial aspects of the Triple Helix Model leading Land Grants away from their established mission?</u>

[12] These federal mission agencies include the National Institutes for Health, National Science Foundation, Department of Energy and Department of Defense, etc.
[13] Shrinking technology life cycles resulted in more rapid diffusion of economic benefits from new technologies (Tassey, 2008).

Since its inception, the land grant university has had a lengthy track record of providing innovative environments for generating new ideas and moving advances in knowledge and technology into the commercial stream as a public good. However, some scholars have suggested that the commercialization incentives created by the Bayh-Dole Act and federal funding schemes are shifting the orientation of university research away from basic and towards applied research. They further contend that the potential costs of university-industry relations could induce threats to academic freedom, lessen open exchanges of information, conflict with the faculty regarding research priorities, and enhance the subordination of fundamental institutional purposes (Washburn, 2005; Slaughter & Rhoades, 2004; Rudy & Coppin, 2007).

Though these concerns are valid, there is little empirical evidence to support increasing corporate capture or crowd-out of public good research in universities. In fact, in 2008 U.S. companies only spent $2.5 billion, or approximately 5 percent, out of their total $219.6 billion R&D investment at U.S. universities. While in contrast, in 2008 approximately 60 percent of all R&D spending at universities came from the federal government (NSF, 2010). [14] Directly sponsored corporate research, therefore is just a small portion of the web of intricate academic-industrial interactions that characterizes the U.S. innovation system.

Research by Mowery & Sampat (2005) has shown that public universities were more active in patenting than private institutions during the pre–Bayh-Dole era. In addition, prior to the passage of the Bayh-Dole Act, 13 of the 20 universities that established technology transfer offices were public institutions (Powell & Rhoten, 2010). [15] With a specific mandate to conduct locally useful mission oriented research, it is not surprising that land grant institutions were among the first to address the issue of ownership of government-funded research results. A 2010 report on managing university intellectual property by the National Academies contends that universities should facilitate technology transfer because public

[14] The remaining 35% of research funding is derived from local and state, philanthropic, endowments, etc. sources (NSF, 2010).

[15] Conceptually, private universities are often perceived to be more driven by commercialization motives and to be influenced by private industry than public institutions.

investments in research has been an explicit national priority for decades. Given the level of that investment, universities have an obligation to organize themselves effectively to facilitate the transition of knowledge into practice.[16][17]

Furthermore, Mowery & Sampat's research (2005) also asserts that university patents per R&D dollar from 1963-1993 reveals an aggregate university patent propensity after 1981, but suggests that it is the continuation of a trend that dates back to the early 1970s. According to the authors, there is no evidence of a structural break in trends in patent propensity after the Bayh-Dole Act. When assessing patents by field, the importance of biomedical patents in the patenting activities of the leading universities has always been important. Non-biomedical university patents increased by 90% from 1968-1980 while biomedical university patents increased by 295% during that same period. According to Mowery & Sampat, the increased share of biomedical disciplines within overall federal academic R&D funding, the rapid advances in biomedical science that occurred during the 1960s and 1970s, and the strong industrial interest in the results of this biomedical research all influenced the aggregate growth of university patenting during this period. Consequently, since 1963 biomedical patents have been the primary driving force of university technology transfer activities.

Moreover, the commercialization of academic life science research is deeply intertwined with the emergence of a new industry, biotechnology, which had its origins in university labs. By 1998, nearly half (49.5%) of all patents issued to research-intensive U.S. universities were based on life science innovations (Owen-Smith & Powell, 2003). One can argue that the large portion of university biomedical patents represents a dramatic shift from basic to applied research by land grant universities, but as Mowery & Sampat (2005) suggest, the field of biomedical research is "characterized by blurry lines between basic and applied research" (Pg. 122) and therefore it is not accurate to assume that increased patenting which was already occurring prior to the passage of Bayh-Dole has shifted the orientation of

[16] This argument is supported by universities themselves in a recent 2010 report by the Science Coalition (a nonprofit, nonpartisan organization of more than 40 of the nation's leading public and private research universities); "Sparking Economic growth: How federally funded university research creates innovation, new companies and jobs."

[17] The National Academies serve as the official advisers to Congress and the President on science, engineering, and medicine.

university research.[18,19] The authors conclude based on these considerations that much of the growth in licensing and university-industry partnerships (which have been highly concentrated in a few fields, such as biotechnology) since the passage of the Bayh-Dole Act almost certainly would have occurred in the absence of this piece of federal legislation.

Land Grants must lead in University Social Responsibility

The rhetoric and concerns about national economic competitiveness have been so widespread since World War II and have resulted in federal and local policymakers continually turning towards the economic capability of the research university. This in turn engages the land grant university in the "Social Contract for Science," which represents the expectation that in exchange for the government's investments, universities would produce public good research that served the nation's interest and solved its societal problems (Guston, 2000). Though as research by Guston (2000) suggests, the "bright line between politics and science is a fine one" (Pg. xv).[20] As a result, the basic framework is set; where there is an ongoing struggle between the usual corruptive influences of politics and the potentially unaccountable self-governance of an authoritative professional community, which include scientists and university administrators. Thus, the embrace of university technology transfer in the knowledge economy has altered the way in which universities are regarded by various key and often conflicting

[18] Mowery et al. (2001) also find that for a sample of three institutions (Columbia, Stanford, and UC Berkeley); academic patenting has not changed the orientations of university scientists. Subsequently, Mowery and Zeidonis (2003) examined patents issued to universities with a range of experience in technology transfer and concluded that aggregate declines in university patent impact (number of patent citations) are largely the result of entry (inexperienced institutions may have filed for patents indiscriminately) rather than of transformations in mission. Reviewing a later time series, Mowery et al. (2002) find that the citation impact of patents assigned to inexperienced (entrant) universities increases in the early 1990s suggesting that new entrants learn over time to strategically identify and pursue more valuable intellectual property.

[19] Rausser (1999) has discussed at some length, inputs allocated to applied research programs can also enhance basic research, just as basic research insights facilitate technological development. Furthermore, Rausser, et al. (2008) find that university/private research partnerships can actually crowd-in basic science research if feedback loops are allowed from discoveries in applied science to expand the opportunity set for public good research. They suggest this is achievable when universities administrators evaluate commercial sponsors based on the potential for significant feedback effects. For example, administrators increase feedback effects by forming partnerships with companies that allow university researchers to access proprietary knowledge that is otherwise unavailable to the public or by partnering with companies that allow and or minimizes delays in academic publication of research results. Rausser therefore concludes that if the university-industry collaborative agreement is structured and negotiated appropriately in terms of benefits, cost, and performance, crowding-in of public good research is possible.

[20] According to Guston (2000), policy in science involves the direction of funds; science in policy involves the provision of expertise from science to politics. This relationship supports the concept of a social contract between the scientific community and the American people as represented by Congress. Accordingly, this may lead to public questions of who science policy is actually serving and what segments of the general public is benefiting from public good research?

constituencies. This includes students, researchers, faculty, administrators, voters, taxpayers, government, and industry (Guston, 2000; Gibbions, 1999).

This has led to the public, once unconditionally confident in science to be more skeptical and even distrustful. Some critics have argued that science has not fulfilled promises made. In particular, they have argued that university technology transfer has not resulted in public good research that serves all of the nation's societal problems, rather only those that have an economic or commercial impact (Gibbons, 1999). Gibbons argues that the prevailing contract between science and society was set up to sustain the production of "reliable knowledge"; and a new one must be established that ensures the production of "socially robust knowledge". Moreover, he asserts that under the prevailing contract, science was left to make discoveries and then make them available to society. A new contract will require the joint production of knowledge by society and science. A new social contract will involve a process in which the authority of science will need to be legitimated again and again (Gibbons, 1999). Consequently, land grant universities will need to lead the way in the 21st century in redefining and renegotiating the social contract for science and in reeducating the public with respect to the diverse benefits and potential of public support for research and discovery.[21]

As land grants universities are enhancing their mission to remain relevant in the global knowledge economy by engaging in more entrepreneurial endeavors, they will struggle to balance conflicting demands from communities, government, advocacy groups and others over the role they should play in economic advancement and social development.[22] No longer is it acceptable for universities to simply make good on their land grant mission to satisfy policymakers while complying with laws and regulations (Washburn, 2005; Slaughter and Rhodes, 2004). The research universities are now called upon by their

[21] Gibbons (1999) asserts that universities should be the leader in creating "socially robust knowledge" (knowledge that is valid both inside/outside of the validating peer group - including lay experts) rather than just producing "reliable knowledge" (knowledge validated by a single peer group - i.e. scientists, university administrators, industry) , which is closed/non-transparent, with no need to justify to society.

[22] As previously noted, land grant universities were selected for this study due to their founding commitment to render service directly to society. Though this paper primarily highlights land grant universities, many public universities established after the enactment of the federal Morrill Act of 1862 were modeled on the land grant tradition and as such, many of this paper's findings can also be applicable to those public institutions.

constituencies to promote University Social Responsibility (USR). This closely reflects the similar demands from consumers for business entities to engage in Corporate Social Responsibility.[23] This concept in part asserts that the university manage the wider social and environmental consequences of their actions, beyond the requirements of the legal and regulatory setting in which they operate (Sen & Bhattacharya, 2001).[24]

If land grant universities are to continue to fulfill their mission in the knowledge-based economy by engaging in entrepreneurial activities, they must implement a diverse portfolio of strategies to promote both commercial and social entrepreneurship and technology transfer. However, if universities maintain the status quo, and help perpetuate the public and media's perception that universities are too entrepreneurial and are making too much money on technology transfer and licensing activities, then governments may threaten to take a portion of their royalties (Ku, 2009; Stevens & Effort, 2008). A diverse portfolio would help to protect their reputation of serving the public good, and by extension, the environment in which they do business. Accordingly, the concept of USR, can be similarly defined as Corporate Social Responsibility, which is expressed as the "the managerial obligation to take action to protect and improve both the welfare of society as a whole and the interest of organizations" (Page 226, Sen & Bhattacharya, 2001). Under USR, in addition to engaging in entrepreneurial activities that induce economic benefits, land grant universities would pursue technology transfer activities that create social value and innovation in areas where commercial market forces do not meet a social need, such as in public goods or in contract failures (Austin, Stevenson, & Wei-Skillern, 2006).[25] Moreover, USR allows land grant universities to fulfill their federal mandate to create economic benefits by allowing them to retain their intellectual property rights and ensure that their innovations create lasting societal change by

[23] According to the Economist Magazine (2008), consumer demand has resulted in $1 out of every $9 under professional management in the U.S. to include an element of "socially responsible investment." In addition, 95% of CEOs surveyed in 2007 by McKinsey, a consultancy firm, said that society now has higher expectations of business taking on public responsibilities than it did five years ago.

[24] Such as the federal incentives to engage in commercial technology transfer.

[25] This failure is often due to the inability of those needing services to pay for them.

reaching large numbers of underserved populations in developing countries (Imtiazuddin & Mohiuddin, 2007).

Accordingly, multiple and diverse intellectual property management strategies are required to deploy university research results for maximum social impact and accessibility. University technology transfer offices have traditionally been assessed by the number of patents they hold, the number of licenses executed, startup companies formed, and license revenue (Mimura, 2010; Imtiazuddin & Mohiuddin, 2007; Stevens, 2008). New definitions of success however are being formulated in how land grant universities are fulfilling their broader mission. This has created opportunities for new models of university-industry contracting including those that benefit the developing world. These models are often referred to as Socially Responsible Licensing Programs (SRLP).

Exemplar of Socially Responsible Licensing Program: UC Berkeley

The concept of socially responsible licensing was first developed at UC Berkeley in 2002. Eva Harris, an associate professor at the School of Public Health, and her colleagues were developing a portable technology (ImmunoSenor) to quickly diagnose dengue fever in the field.[26] The ImmunoSenor is a user friendly, point of care device that can detect antibodies or infectious agents in a clinical sample rapidly and accurately. With funding from the Acumen Fund (a non-profit global venture fund that uses entrepreneurial approaches to solve the problems of global poverty) to apply this technology for large-scale use in diagnosing multiple infectious diseases in developing countries, Harris needed a creative licensing agreement to ensure that the new tool could have its intended social impact. Harris proposed a licensing agreement to UC Berkeley that would allow her nonprofit, Sustainable Sciences Institute to develop and distribute the technology to underserved countries for free or at cost, while maintaining the university's right to earn future royalties from derivative technologies distributed in developed countries (Mimura, 2006,2010; Imtiazuddin & Mohiuddin, 2007).

[26] The current diagnostic technology uses Immunoassays, such as Enzyme-Linked Immunosorbant assays (ELISA), which requires costly equipment and skilled technicians. This technology is typically only available in a few tertiary care hospitals in developing countries.

This proposal represented a fundamental shift in standard licensing models at universities, which encouraged UC Berkeley's technology transfer office to restructure their valuation process to include the double bottom line concept. According to Carol Mimura, the head of UC Berkeley's Office of Intellectual Property and Industry Research Alliances (IPIRA), the university openly embraced the concept, and described it as a two pronged evaluation of the financial bottom line and the scope of social impact, both being equally import to UC Berkeley. This experience led UC Berkeley to be the first university in the country to formally adopt an SRLP (Imtiazuddin & Mohiuddin, 2007).

Since 2002, UC Berkeley has entered into over 15 agreements with for-profit corporations and non-profit entities under the SRLP. The highest profile agreement involved a $42.6 million grant from the Bill and Melinda Gates Foundation for Amyris Biotechnologies, UC Berkeley, and the Institute for One World Health and sub-licensee sanofi-aventis for developing a low-cost malaria drug.[27] The initial contract structure allowed Amyris to follow a dual commercialization strategy. For the nonprofit strategy, they provided the drug for malaria field use in 90 malaria endemic developing countries. Amyris was exempt from payment of royalties to UC Berkeley, but it was contracted to pay fair royalties on products outside the malaria field of use, which included developed regions. The second strategy allowed the company to apply the same platform technology to pursue for profit commercial goals, including biofuel applications (Mimura, 2010 & 2006). The company has achieved a tremendous amount of initial financial success in the commercial sector. Most notable, it had an Initial Public Offering (IPO) on the Nasdaq exchange in September, 2010 (Kane, 2010).

Royalty free (or at cost) licensing agreements under SRLPs preserve the economic incentives for academic institutions and industry. Particularly in the pharmaceutical and biotech field, this allows them to leverage technology transfer, manufacture and develop infrastructure that has the potential for a much greater impact on public health issues worldwide. SRLPs can ensure that these improvements reach a

[27] This drug is a semi-synthetic artemisinin from microbial fermentation.

larger proportion of the underserved market worldwide (Mimura, 2006, 2010; Imtiazuddin & Mohiuddin, 2007).

The full extent of the academic research's ability to develop new drugs and therapies has only been recently documented. A study currently underway at Boston University (Stevens, 2010) has found that 153 vaccines, small molecule drugs, biologic drugs, and medical diagnostics have been discovered in whole or in part at academic institutions, patented, licensed and have reached the market since 1980.[28] As drug developers, universities have incredible leverage and responsibility to negotiate for open access and less costly treatment in developing countries.[29]

Policy Recommendations

The federal Morrill Act of 1862 created a new type of higher education institution in the 19th century to stimulate economic development and promote higher educational attainment. Today land grant universities in the U.S. play an increasingly pivotal role in the 21st century economy. These universities not only fuel innovation at local and regional levels, they also engage with the rest of the world on increasingly complex and interconnected set of issues. Land grant universities have the ability to leverage global science and technology capacity to improve the lives of the very poor. As previously argued, land grant universities should take the leading role in promoting USR, which demands an approach to science, technology and research in which contributions to the economically disadvantaged is given value and attention. Moreover, the central tenets of USR encourage universities to focus on approaches to find advanced technological solutions that are socially robust.

The following set of policy recommendations can help guide land grant universities to effectively engage in USR platforms:

[28] A 2000 report from the U.S. Congressional Joint Economic Committee found that 15 out of the 21 drugs with the most therapeutic impact were derived from federally funded projects at academic intuitions.

[29] As previously referenced, Rausser's (2008) research has shown that university-industry collaborative agreements, if structured and negotiated appropriately in terms of benefits, cost, and performance, can induce the crowding-in of public good research.

Establish USR as a policy

The mission and the operations of the technology transfer office should be clear to the university community and beyond. Within that mission, universities should make socially responsible licensing a formal institutional policy. A formal policy strengthens the licensing officer's position during contract negotiations if they can refer to institutional goals or requirements.

However, such policies should not include "boilerplate" contract language. The USR policy should be a collaborative process between the university and industry. Language for USR should be crafted during the negotiation process, instead of asserting in advance prescriptive provisions and conditions. Such prescriptive approaches have been shown in the past to be ineffective and can have a chilling effect on university-industry innovation. For example, during the 1990s the National Institutes of Health's (NIH) "Reasonable Pricing Cause" in their Cooperative Research and Development Agreements (CRADAs) illustrated that boilerplate contractual language which imposed a future obligation to provide products at "reasonable cost" can discourage investment.[30]

Boilerplate language can create an impasse during negotiations leading to no deal at all, and as a consequence, no commercialization of the drug. According to Carol Mimura, Assistant Vice Chancellor for Intellectual Property and Industry Research at UC Berkeley, "Industry pipelines are littered with drugs that fail in clinical trials, or even after approval. If there is no value proposition to justify investment, or if prospects are marginally attractive and will be made even worse due to the imposition of licensing terms that exceed a threshold of uncertainty, then we have little leverage, indeed" (Page 15, Mimura, 2010). In such situations, Mimura suggests that the university at minimum can abstain from filing for IP rights in developing countries. A stated policy can also stimulate philanthropic activities. For example, UC Berkeley received several substantial donations

[30] *Antiviral Agents Bulletin*, "PHS/NIH Abandons Reasonable Pricing Licensing/CRADA Policy." April 1995, p. 106-7. http://www.bioinfo.com/reasprice.html

to encourage public health IP in developing countries since they adopted a USR policy (Mimura, 2010).

Restructure the Technology Transfer Office

A university must have a clear set of principles upon which to make licensing decisions. For many universities these decisions are principally based on financial considerations. Many university technology transfer offices seek to be a profitable "business" within a university environment. However, in most situations within the university, the financial bottom-line cannot be the only determining factor because there are too many other factors to take into consideration, such as University Social Responsibility (Ku, 2009).

To bridge the USR policy with practice, universities should combine IP licensing and industry-sponsored research functions under a single unit. This reorganization creates a central point of access for industry to the university's research capability and research outcomes. Consolidation can change the metrics of how technology transfer is evaluated.

This restructuring can create a double bottom-line that includes not just the revenue bottom-line but also the social-impact bottom-line. When units are merged, mechanisms such as royalty-free licenses are not financially detrimental to the revenue bottom line of the technology transfer office, since the USR policy can stimulate net funding (industry and philanthropic), new partnerships, enhanced reputation, improved relationships with faculty, students and alumni, and public good will that can be considered more value than lost revenue (Mimura, 2010; Yu, 2009).

Ensure transparency in the patenting and licensing of publicly funded research

Over the last several decades the measurement of technology transfer has significantly improved. Currently, virtually all universities that engage in technology transfer provide universal data and reports to the Association of University Technology Managers (AUTM). This data allows the university, governments, and the public to assess the position of a given university with that of their peers. AUTM is a trade organization that is committed to improving the quantitative and qualitative measurement of university technology transfer. However, the existing AUTM metrics and those used by universities themselves do not provide a clear picture of how they are engaging in USR platforms.

Therefore, in addition to the common technology transfer reporting metrics, such as the number of patents/licenses obtained; the funds expended on patenting and licensing activities, licensing revenues, and number of startups; the following key data should also be publicly reported by universities:

- Number of exclusive or nonexclusive licenses
- Humanitarian access/social impact initiatives/policies
- Areas of market segmentation or field of use (restrictions or use in developing countries)
- Number of royalty-free licenses executed
- Number of licenses provided to non-profits

These additional transparency measures will help the public and governments determine how the university is serving the public interest and whether it is implementing measures that support USR.

Further Research Needed to Promote USR:

Retaining royalty income to help support Social Impact Research

The federal Bayh-Dole Act requires that patent and licensing royalties be shared with the inventor and any remaining income be used for education and research purposes (less administrative and legal fees). Further research should be conducted on the feasibility of enacting a policy that would require a certain percentage of royalty income be used to support social impact research. Without a direct and stable funding source from the university, it may be difficult to promote and support social impact research among faculty.

Waiver of Federal Fees for Social Impact IP

Most universities license less than a quarter of their active invention portfolios. As a result, individual licensing agreements need to cover the cost of unprofitable patents and administrative and legal overhead. This scenario typically leads to technology licenses being viewed as a revenue vehicle via fees and annual payments, which can make university managers reluctant to license inventions to startups and nonprofits that have limited cash flow and that are seeking to promote social impact via IP (Kurman, 2011). Accordingly, further research should be conducted on whether USR can be promoted by waiving federal patent application fees for university inventions that have humanitarian application and/or offer royalty-free licenses. Such waivers may have the ability to make it more cost-effective for universities to promote USR platforms.

Conclusion: The University's New Social Contract with Science and Economic Development

Land grant universities can develop a dual paradigm which maintains its mission to enhance economic prospects of society (the charge of its enabling legislation) but also ensures that it produces scientific knowledge and outcomes that are socially robust. As the land grant university extends its reach in the global knowledge economy, social returns will become increasingly important to the identity and reputation of leading universities and the multinational corporations that they partner with. By developing diverse intellectual property management portfolios, they can combine positive financial and reputational returns. Land grant universities like UC Berkeley are acknowledging that while license revenue generation and local economic development goals are important to their mission, it is equally important to maximize the social impact of research and provide public goods where market forces alone are unable to address these problems.

The former President of the University of California system, Clark Kerr (1963) once viewed the university as having no single animating principle, and stated "the university is so many things to so many people that it must, of necessity, be partially at war with itself" (Page 7). Kerr believed that the modern university should act from a perspective that encompasses the multiple duties which are placed upon it by the people whose life it enters in so many ways.[31] Consequently, due to this reality, the creation of useful knowledge and technology in the 21st century will continue to alter the way in which universities are regarded and valued by various key and often conflicting constituencies. The

[31] Kerr introduced the idea of a "multiversity" which covers the polymorphic nature of the university, encompassing its dispersed activities, its inconsistencies in objectives, its contrasts in approaches, its cultural discrepancies, and its conflicting constituencies (Kerr, 1963).

fundamental land grant principles of accessibility, practical as well as classical education, research and discovery in the public interest remain powerful and profound today. Land grant universities, however, must lead the way in the 21st century in renegotiating the social contract for science and in reeducating the public with respect to the diverse benefits and potential of public support for research and discovery.

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