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Clark Kerr's Multiversity and Technology Transfer in the Modern American Research University

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In the early 1960s, Clark Kerr, the famed American educationalist and architect of the California public higher education system, took up the task of describing the emergent model of the contemporary American university. Multiversities, as he called them, were the large powerful American universities that packaged the provision of undergraduate, professional and graduate education and focused intensively on research production. Kerr was describing the model of the Anglo-American research university that had emerged in the U.S. during the first half of the 20th century. This model shared or had borrowed characteristics with older models for how a university is constituted and how it interacts with society, but it was also a novelty in a variety of ways. During the second half of the 20th century and into the first decade of the 21st, universities that aligned with Kerr's 'ideal type' have become predominant in the US, England, Canada and throughout the world (Fallis, 2007). These expansive institutions are critical components in most if not all developed countries and are considered as essential not only for economic growth (Evans, 2006; Mowery & Sampat, 2006; Dill & van Vught, 2010), but also in serving a wide variety of communities and interests (Kerr, 1982; Fallis, 2007).

One of the major differences between Kerr's university model and those preceding it was that instead of having one central animating idea, the multiversity had many. A plethora of sometimes conflicting uses led Kerr to claim that "the university is so many things to so many people that it must, of necessity, be partially at war with itself" (Kerr, 1982, p. 8). One of the uses of the multiversity that has gained prominence over the past three decades in particular is the transfer of technology and research for industrial use and economic growth. This university function has risen in importance in conjunction with the emergence of the knowledge economy (OECD, 1996) and the increased recognition that universities are of central importance to economic growth, competitiveness and industrial innovation as part of complex national systems of innovation (Dill & van Vught, 2010).While few universities were engaged in substantial efforts at research commercialization or technology transfer when Kerr was writing his book *The Uses of the University*, nearly all universities are doing so now, to varying degrees of success (Phan & Siegel, 2006; Geiger & Sá, 2008). Five decades after Kerr's landmark book, it is opportune to assess how the technology transfer 'use of the university' fits into Kerr's model today, and how the widespread appearance of technology transfer offices (TTOs) may be changing the structure and functioning of the contemporary university and of society.

This paper will explore the ways that the evolving commercialization mandate for research and its most important related structure, the TTO can be understood with reference to the multiversity and its historical

antecedents. It also seeks to advance understanding of how TTOs may affect the internal balance of power in the multiversity. It employs as a specific historical example the University of Wisconsin, known to have one of the oldest and strongest technology transfer offices (Geiger and Sá, 2008).The first section will trace the historical evolution of university models that build up to Kerr's model of the multiversity. Next, the TTO will be defined and contextualized. Finally, the University of Wisconsin's TTO, the Wisconsin Alumni Research Foundation (WARF) will be introduced and some examples of its powerful role within the university, and more broadly, will be provided.

The Origins of the University

The first universities in the western world emerged in the medieval age a little less than a thousand years ago in places like Salerno, Bologna and Paris. These early institutions came about spontaneously as scholastic guilds of masters and students. They were similar to other professional guilds that existed at the time and initially had no formal authorization to operate (Rashdall, 1987). Catalyzed by the instinct of association, they appeared across medieval Europe throughout the eleventh and twelfth centuries (Rashdall, 1987). It was at this early stage that the attributes of independence and integrity that would come to mark the more modern incarnations of the university first took root. In addition to the instinctual association of scholars, these guilds arose also in response to market forces and were an attempt to harness education to fulfill the professional, ecclesiastical and government requirements of the day (Fallis, 2007).

The formal recognition of the University of Toulouse by Pope Gregory IX in 1233 was a watershed moment for the university as an institution (Rashdall, 1987). While early university precursors emerging from the original guilds of masters and students had existed for some time prior to the papal bull, this Act set a powerful precedent for giving the university its formal autonomy. It stipulated that a teacher authorized to teach at one recognized university, would have the right to teach anywhere without further examinations (Rashdall, 1987). Other universities would soon seek this same papal recognition, and it became an important defining characteristic of the university and symbol of institutional autonomy.

Medieval universities were utilitarian in character, but they also carried with them traditions of liberal education that could be traced back to Greek and Roman philosophy (Fallis, 2007). The Association of American Colleges and Universities (n.d.) defines liberal education as that which provides individuals with broad knowledge and transferable skills. It is a philosophy of education meant to instill a strong sense of values, ethics, and civic engagement. Liberal education does not set students on a specific course of study or field, but rather trains them in a broader sense. While as Fallis argues, medieval universities carried on the tradition of liberal education, their emergence was more the result of practical needs of society, and the training of professionals was initially their primary reason for being.

In the mid-1800s, some 500 years after the first universities gained papal recognition, Cardinal Newman, writing in a much different age, composed his highly influential *The Idea of a University*. In this work, the liberal education component that had been somewhat dormant in the medieval university was empowered. Newman advocated staunchly for a different type of university, one that was divorced from utilitarian mandates and guided instead by moral philosophical purposes (Kerr, 1982). His book has been credited as being the most influential ever written about universities (Fallis, 2007) and is to this day invoked in commencement speeches and other important university texts around the world.
Newman wrote his treatise on the model university after being assigned the role of creating a Catholic university in Ireland. Based on his experiences at Oxford, and motivated by the task to which he had been assigned, Newman set out to define the ideal university. Newman wrote of the university as the high protector of all knowledge, science, fact and principle, inquiry, discovery, experiment and speculation (Newman, 1996). He emphasized liberal knowledge, and was not concerned with practical, specific knowledge or the generation of related expertise. He was driven by the belief that knowledge could be its own end, that it was its own reward, and that it needed not be sought for utility's sake (Kerr, 1982). Eclipsed were the utilitarian values of the guild, which had been long ago replaced by the likes of Oxford and Cambridge in England. Instead, a new model or 'ideal type' of the university emerged and was staunchly defended as *the* model to be aspired to by any society wishing to advance itself, guard its traditions and glorify its culture.

Newman was not dismissing the need for training expert professionals or conducting research, rather, he believed that other institutions than the university should be made responsible for this (Kerr, 1982). This belief was grounded in the understanding that scientific and philosophical discovery through research left out the role of the student, and educating students and turning them into well-rounded citizens was the single function that should really matter for such an important and unique institution as the university. Newman (1996) wrote that university training "aims at raising the intellectual tone of society, at cultivating the public mind, at purifying the national taste, at supplying true principles to popular enthusiasm and fixed aims to popular aspiration, at giving enlargement and sobriety to the ideas of the age, at facilitating the exercise of political power, and refining the intercourse of private life" (p. 125). Overall, he saw the role of the university as that of preparing individuals to be able to fill any post admirably or to master any subject with ease. Its overriding objective was undergraduate education (Fallis, 2007) and its goal was improving civilization. It was not an institution that should be concerned with the advancement of democracy, which was then slowly emerging, or of the industrial revolution, which was increasingly demanding specialist knowledge (Fallis, 2007). Newman had only the highest hopes for the university, and these were not of a practical nature.

However, even as Newman was attempting to codify his idea for what a university is and should be, this model was being overtaken by another model that was achieving great success in mainland Europe. Newman's disdain for the more directly practical uses of the university in society was at odds with the highly successful model of the university that had begun

to take shape in Germany over the course of the 1800s. By the 1930s, an American scholar named Abraham Flexner was writing about a new type of university, an idea of a modern university that came from Germany. Founded in 1809, Prussia's University of Berlin had by the early 20th century become a pre-eminent model of a new type of institution in which research was a dominant purpose (Scott, 2006).

Scott (2006) claims that the German model of the university emerged for two reasons. First, it was driven by Prussian intellectuals and aristocrats who proposed it as a response to the perceived stagnation of German academia. Second, it was supported by Prussian government as a new source of national pride and redevelopment much needed after the defeat of the Prussian army by Napoleon. The University of Berlin and others represented "nationalistic philosophical, historical and literary culture" (Scott, 2006, p. 20), and it was hoped they could reinvigorate Germanic society.

More than any other individual, Wilhelm von Humboldt was responsible for creating the German university model. He enacted deep and lasting reforms for education at the secondary and post-secondary levels during the early 1800s and posited a single basic doctrine to guide the efforts of universities: "to appoint the best intellects available, and to give them the freedom to carry on their research wherever it leads" (Fallon, 1980, p. 19). Three related principles also became paramount in the German university model were and ultimately of great importance in understandings of the university around the world. First was that research and teaching missions should be unified and that generating original scholarship was among the highest university goals. Second, students must be free to study and professors must be free to teach and to investigate freely the topics that interest them. Third, that the pure research of the arts and sciences should be elevated in academic status to the same level as faculties of medicine, law and theology (Scott, 2006).

By the early 1900s, the model of the practical, state-supporting, research-heavy university was threatening the Oxford and Cambridge model, still clinging to the singular importance of liberal education and its emphasis on knowledge for its own sake. The dominant model of the university was changing because societies were changing. According to Flexner (1930), universities could not be held separate from social change because they were a part of "the general social fabric of a given era" (p. 3). They were expressions of the age and could not survive if clinging to the past. The German model designed by Humboldt and growing in prominence over the 1800s best embodied this idea of interconnectedness with society.

By the 1930s, universities in Germany and elsewhere were evolving with the societies of which they were a part. New departments, institutes and massive research libraries were being added. The researcher in his laboratory came to replace the philosopher in contemplation (Kerr, 1982).The more abstract purpose of civilizing people through liberal education was deprioritized as new priorities were added. The more concrete, immediate needs of society for the advancement of science and technology, the creation of better techniques and processes for governing,

industry, medicine etc., rose to the heights of the university's core mission (Kerr, 1982). The days of a single individual mastering a subject were gone and as Kerr (1982) noted, so too perhaps was Newman's universal liberal man. Instead of training generalists, specialists were being trained and the fruits of this change appeared to be manifesting in the rise to European power of the Prussian and then the unified German state.

The Humboldt model was in many ways based on the great ideas of the enlightenment, that "knowledge came from reason and observation, not from revelation and tradition" (Fallis, 2007, p. 28). Discovering new knowledge was the cornerstone of the German model and professors were not generalists who taught diverse aspects of the curriculum, they worked principally in their own fields of knowledge. By the late 1800s, German universities of this model had become world-leading centres of scientific research and graduate education, and they were admired and emulated. Associated ideas about academic freedom and the university structures that had been created became enormous influences on the evolution of universities first in the United States, and later throughout the world (Fallis, 2007). The university as "an institution consciously devoted to the pursuit of knowledge, the solution of problems, the critical appreciation of achievement and the training of men at a really high level" (Flexner, 1930, p. 42) became the new ideal type that university administrators and governments aspired to create.

While he championed the idea of a modern university, Flexner also worried that this transition away from Newman's model was leading universities to become too many things, and to have too many frivolous missions. He was fearful of the possibility that universities would become crude service stations to humanity (Kerr, 1982). While he was enthusiastic about the growing utility of the university, he still held that there were limits to this utility and that a genuine university should be defined by its highness and definiteness of aim and unity in spirit and purpose (Flexner, 1930). Despite these reservations, the German model of the university continued to be transplanted to the US.

Kerr's Multiversity

The multiversity that Kerr described in the 1960s was much more like the German model than like the idea of a university described by Newman. Fallis (2007) argues that Kerr's multiversity is in fact a combination of pieces, or vestiges, of the several models of the university that preceded it. It was partly the medieval university and its guild-like structure focused on professional training and partly Newman's university with its undergraduate liberal education focus. It had a healthy dose of the German university encompassing a new focus on graduate education, research and science, and even contained elements of Scottish institutions that emphasized mass accessibility and applied science (Fallis, 2007). From each of these models the multiversity contained pieces, which were assembled as needed.

However much the multiversity borrowed from its European predecessors, it also gained particular characteristics from its unique American upbringing. The seed for today's American multiversity was planted in the establishment of Johns Hopkins university in 1876. Johns

Hopkins imported a great deal of the German model of a university, and emphasized research and graduate education above all else (Kerr, 1982). It set such a powerful standard in the US that within four decades, the research mission that it imported came to dominate all US universities (Scott, 2006). All of the elite American universities, which had been undergraduate-focused, added graduate schools as did the state run universities, all of which were quick to follow Johns Hopkins' lead (Fallis, 2007). A new research function was added to nearly the entire collection of major US universities.

Another key development was the *Morrill Act* of 1862 in which the US federal government provided land to the states for the creation of universities (Scott, 2006). New state-owned universities served regional interests for social and economic development. They provided wide access for the children of farmers and industry workers, and offered degrees in applied fields like agriculture and business (Kerr, 1982). Rather than staying exclusively to this original mission, the public land-grant universities soon began acquiring the characteristics of the private elite universities, including liberal art faculties and graduate schools. At the same time, the elite institutions took on many of the features of the public schools. Instead of a system of differentiated institutions serving different purposes, American universities, public and private, evolved in parallel as conglomerates of undergraduate, graduate and professional education, and of course, research. Fallis(2007) notes that these institutions "proved to be flexible, responsive and entrepreneurial, taking on new tasks, expanding their enrolments, establishing new departments, new graduate programs, new research centres, and new professional schools all within the same institution" (p. 51).

The new institutional form that was emerging, although diverse and flexible, was heavily influenced by its research mission. The formation of graduate schools, the agricultural and engineering research bases of the land-grant universities and also the growth of medical education provided fertile ground for the research agenda to grow (Fallis, 2007). Research leading up to the Second World War was strengthened by funding from organizations such as the Rockefeller and Carnegie foundations (Scott, 2006). However it was after the Second World War that research really flourished in US universities. Of particular importance was the ideological support provided by Vannevar Bush, post-war director of the Office of Scientific Research and Development, who led the call for the US government to increase its support of basic research in universities as opposed to government laboratories or private industry (Bush, 1945). The emphasis on research being conducted in the university was important, according to Bush, because it kept scientific investigation at arms length from government or industry interests, which were likely to be influenced by practical concerns and to curtail academic freedom (Bush, 1945). The focus on university research in the US contrasted with the more dominant model in Europe where research was conducted in government labs (Fallis, 2007).

Bush's highly influential line of reasoning for increasing investments in research at universities, justified by the importance science had played in the war, set the stage for unprecedented increases in US federal

support for university research. Fallis (2007) notes that from 1953 to 1968, federal funding increased by 900 percent, adjusted for inflation. Funding continued to increase at lower, but still impressive throughout the final quarter of the 20th century (Fallis, 2007). This funding did have some powerful transformative effects, however, such as fragmenting faculty, boosting those active in research, weakening the research-poor disciplines such as the humanities, and initiating a fierce competition for talent (Marginson, 2008).

As the second half of the 20th century progressed, the American university had taken on many roles and had become 'useful' in a variety of ways, none greater perhaps than its swelling research mission. A new institutional form, a new ideal type, had emerged in which numerous communities, activities, and objectives were held together by a common name, common governing board and a set of related purposes (Kerr, 1982). Kerr (1982) saw the university as a "city of infinite variety" where "[s]ome get lost in the city; some rise to the top within it; most fashion their lives within one of its many subcultures" (p. 41). The multiversity was established and here to stay.

Like past incarnations of the university throughout the ages, knowledge remained primary in the mission of the multiversity. However, the emerging predominance of the research mission meant that it was the generation of new knowledge as championed by Humboldt and Flexner that Kerr emphasized rather than the received knowledge of Newman. New knowledge, created by research, was a driver of modernization and Kerr was particularly astute in his early recognition of the role this would play in the emerging knowledge-economy. He proclaimed that "[k]nowledge has certainly never in history been to central to the conduct of an entire society" (Kerr, 2001, p. 66). He asserted that the knowledge industry would do for America in the second half of the 20th century what the automobile had done in the first half, and the railroad in latter part of the 1800s. The university, he contended, "is at the center of the knowledge process" (Kerr, 2001, p. 66).

By the start of the 21st century, Kerr's mantra about the predominance of knowledge production could be found woven into the dominant political discourse among advanced countries. Knowledge production had taken the place of natural resources and manufacturing as the foundation for economic growth, industrial innovation and international competitiveness. Influential organizations such as the Organization for Economic Co-operation and Development (OECD) were proclaiming the university to be central to the new knowledge-based economy (OECD, 1996). Universities and particularly university research were positioned at the very centre of complex national systems of innovation (Mowery &Sampat, 2006; Dill & van Vught, 2010).

Today, the question for policy makers and university administrators is no longer *if* universities play a key role in economic growth and competitiveness, but *how* this role can be enhanced to more fully take advantage of the funding that goes into them. The national systems of innovation literature emphasizes that enhancing this role requires paying attention to the complex, recursive linkages between universities and

industry and government, as these connections are the critical factors affecting potential growth and innovation (Lundvall & Borrás, 2006). Understanding and improving these linkages is therefore of primary concern to many universities, and also to the governments and taxpayers who have shown an incredible willingness to fund them, particularly for research.

The Technology Transfer Office

In writing about the governance of the multiversity, Kerr (1982) noted that it is an institution with many different internal communities and that its edges are "fuzzy". The multiversity, he says, "reaches out to alumni, legislators, farmers, businessmen, who are all related to one or more of these internal communities" (Kerr, 1982, p. 19). One of the most important ways that the multiversity reaches out to its external stakeholders is through disseminating the results of its research. Increasingly, dissemination means transfer to industry, and the TTO is the primary vehicle for this important type of dissemination. It is the most important fuzz on the edge of the university.

The university TTO, sometimes also labelled the 'industrial liaison office' (ILO), refers specifically to the variously named organizational units responsible for patenting, licensing, and other activities associated with the management of university intellectual property (IP), including the creation and incubation of spin-off companies (Geiger and Sá, 2008). Fisher and Atkinson-Grosjean (2002) refer to these entities as the "university's brokers in the knowledge market" (p. 450), because they are located on the boundary of public and private enterprise - between academy, industry and state - and they must act as mediators among the often antithetical interests and cultures of each group.

Despite the ubiquitous presence of TTOs at all major research universities in the US since the end of the 1980s (Colyvas & Powell, 2008), the experiences of individual universities in technology transfer vary markedly. The edges of some universities, as mediated by the TTO, are much more interactive than others. Some university TTOs have decades-long histories of financial self-sustenance, of receiving windfall licensing revenue, of spinning off globally known companies, and of being widely appreciated as major contributors to local and regional economies (Geiger and Sá, 2008). However, many TTOs have failed to succeed in technology transfer or have enjoyed only mediocre success (Phan and Siegel, 2006).

TTOs operate in a highly contested space between the worlds of academia and business. The tensions inherent in their work due to the dual or "Janus-faced" role they play is a constant factor problematizing the already technically challenging task of translating basic research findings into marketable products. TTOs are held to complex and sometimes contradictory standards (Fisher & Rubenson, 2010). They operate against the backdrop of contentious society-wide debates regarding the threats of 'academic capitalism' (Slaughter & Rhoades, 2004). In some ways they embody the residual tension between the competing visions of a university as either a pursuer or knowledge for its own sake, or for the sake of utility. They are highly visible symbols of the potential corruption of

the ‘normative structure of science’ elaborated by sociologist Robert K. Merton (see Kirmsky, 2003). Despite the contested space in which they operate, and the challenges they face, these entities have in some cases become powerful agents of change with major influence over universities and their roles in society.

The rise to importance of the technology transfer mandate and the TTO emerges from the increasing importance of the research agenda in American universities and the evolving policy discourse that has underscored the importance of universities in the knowledge economy and in national systems of innovation. As governments funnelled more and more funding into universities, and consensus built that universities are at the core of modern economies, expectations about their potential inputs into industry and the market grew.

Legislative and judicial changes in the US also played a role not only in legitimizing the place of the university as a knowledge producer, but in incentivizing it to develop, protect and exploit intellectual property (IP). Prior to the 1970s, few universities put a great deal of emphasis on patenting and licensing (Geiger and Sá, 2008). However, a series of patents on the process for manipulating genetic material filed in 1978 by the University of California (UC) and Stanford that led to over $200 million in licensing revenue (Geiger and Sá, 2008) brought the financial potential of university-generated IP to light. Kerr (1982) had noted some 20 years earlier how responsive the multiversity was to money. The example of substantial financial gains by UC and Stanford from an extraordinary scientific breakthrough was a powerful motivation for many universities to increase their engagement in technology transfer. A series of subsequent legislative and court decisions provided even further motivation.

In 1980, the US Congress passed the *Bayh-Dole Patent and Trademark Amendments Act*. The passing of the *Bayh-Dole Act* is considered a watershed for US university-industry relations because it standardized the regulations for ownership and marketing of university intellectual property generated through federal funds, giving universities the right and an obligation to patent and license the results of federally funded research (Owen-Smith, 2003). It also made explicit the US Congress’ support for the commercialization of publicly funded research (Popp Berman, 2008), leaving little doubt in the minds of university administrators that this was a path they could not afford to circumvent. In addition to Bayh-Dole, subsequent court decisions broadened the category of what could be patented including organisms, research tools and even some basic scientific discoveries (Geiger and Sá, 2008), further enhancing the financial potential for this area of university activity. A new use for the university had emerged and the TTO was its primary constituent.

University of Wisconsin

While a host of universities that had not been very active in patenting and licensing prior to the 1970s and 1980s began to increase their efforts thereafter, some universities were well prepared to benefit from the technology transfer agenda enshrined in the *Bayh-Dole Act*. The University of Wisconsin (UW) is perhaps the pre-eminent example among these

universities. Its TTO, the Wisconsin Alumni Research Foundation (WARF) is well known around the world for its effectiveness in technology transfer (Geiger and Sá, 2008) and has become a prominent part of the university.

WARF was launched in 1924 on the heels of a major discovery by a UW researcher named Harry Steenbock who came up with a novel process for fortifying food products with additional vitamin-D (Litan, Mitchell & Reedy, 2007). His process, which has been credited with helping to eradicate rickets worldwide (George, 2005), had major commercial potential, but the university's administration, particularly the Board of Regents, was slow to react in advising Steenbock on the appropriate course of action and in assisting him in the technology transfer process (Apple, 1989). Eventually the board made it clear that the university was not interested in directly supporting the complex and potentially costly transfer process.

George (2005) notes, that in alignment with the norms of the period, "UW as a public-funded academic institution was reluctant to be seen as creating economic benefit from public-funded research" (p. 121). Apple (1989) adds that the speculative nature of investing university funds in technology transfer and the uncertainty of any return on those funds also dissuaded the board from a more proactive and supportive response to Steenbock's work. In response, Steenbock and a group of alumni proposed and won approval for the creation of an independent organization managed by "friends of the university" that could provide support for commercializing Steenbock's research and the future work of other UW scientists (Apple, 1989, p. 383). Guided by the belief that a public educational institution was not capable of running a successful, efficient business, and with the help of a few hundred dollars of alumni donations WARF was created (George, 2005).

WARF was managed independently of the university, but the proceeds it collected from patent licenses were transferred back to the university for funding future research (Apple, 1989). WARF acted as an interface between the university and industry and was responsible for commercializing research in ways that would protect the public good by preventing monopolies, ensuring quality of products and integrity of advertising and funnelling any profits back to the university (Apple, 1989). Since its launch, WARF has served as a model for the TTO that other universities have tried to emulate (Geiger and Sá, 2008). WARF's success has been attributed to several key factors. George (2005) asserts that being set up as an independent organization not beholden to university budgets and the politics of securing resources, has given WARF a major advantage over other TTOs. This independence has depended on the substantial licensing revenue from the Steenbock patent and others since WARFs founding. Lack of reliance on the university for funding has allowed WARF to support more TTO staff than other universities (Geiger and Sá, 2008), and to invest in capability development even when the prospects of immediate performance payoffs are low (George, 2005). As of 2011, WARF employed 71 full-time equivalent staff members, making it one of the largest TTOs in the US (Association of University Technology Managers, 2012).

The fruits of WARF's early start and financial independence are its cumulative expertise due to decades of organizational learning in the process of technology transfer. By the mid-2000s, WARF had processed nearly 5000 disclosures of potential inventions, obtained over 1500 patents, entered into 1400 license agreements with companies and had equity in 35 start-up ventures (Jain & George, 2007). As part of the university's fuzzy edge, WARF interacts with many businesses and, in so doing, it helps the university to justify the substantial public investments it receives each year from state and federal government. Within the university, WARF holds workshops and seminars to educate faculty and staff on what is and is not patentable, and about the technology transfer process in general (George, 2005). These types of activities might be assumed to have some impact on the organizational culture of the institution and the orientations towards commercialization of the faculty as well.

Windfall licensing revenue over the years has allowed WARF to nurture an endowment that today stands at over $1.5 billion (USD). That the UW's TTO has an endowment only slightly smaller than the university's own, which currently stands at $1.87 billion (USD) (University of Wisconsin, 2012), is a testament to its success and to the power it wields inside the university more generally. The size of the endowment, created through alumni donations and the proceeds from university licenses and equity in spin-off companies, is also evidence of the power that WARF carries in guiding the institution's future. WARF donates upwards of $50 million (USD) to UW for research each year (Jain & George, 2007) thereby influencing the research agenda.

WARF has also used its endowment to support special university initiatives such as the strategic hiring of faculty. In the 1990s, UW went through a prolonged fiscal drought, and lost 288 faculty positions (Geiger and Sá, 2008). Near the end of the decade, WARF provided $5 million (USD) out of a total of $15 million of state and university funds in order to hire clusters of new faculty members, primarily in the life sciences, and as a means of promoting the technology-based economic development agenda (Geiger and Sá, 2008). WARF plays a role in setting the course for the university, as its funds impact both the research that takes place and even the faculty who are hired to undertake it.

However, WARF's role in technology transfer goes beyond the immediate vicinity of the UW campus or the businesses with which its technology transfer offices interact. Geiger and Sá (2008) note that "WARF also serves as a national spokesperson for technology transfer and was instrumental in the developments leading up to Bayh-Dole" (p. 237). In the late 1960s and early 1960s, WARF's management negotiated patent sharing agreements with federal funding agencies so that federally-funded research conducted at UW could be patented and licensed by the TTO (WARF, 2012). The underlying logic was that the university's TTO was much better suited to manage patents and find licensees for these previously federally owned patents. These agreements were precursors to the nation-wide Bayh-Dole Act that would be enacted a decade later. WARF not only set a successful example for the watershed national legislation, it also played a key role in lobbying the government to pass it.

According to the WARF webpage, its management at the time "spent countless hours lobbying for the legislation, testifying before Congress, and assembling compelling examples of promising research whose development had been thwarted by the government policies then in place" (WARF, 2012).

Another example of the power that a TTO such as WARF has come to wield in society is connected to its management of a set of patents related to human embryonic stem cell research. Following research conducted at UW by James Thomson in the 1990s, WARF was able to secure patents giving it the legal right to prevent anyone in the US from making, using, selling and even importing human or primate stem cells (Golden, 2010). Geiger and Sá (2008) note that the work towards these patents paralleled work being done broadly in this field and were certainly not a breakthrough. Nonetheless, WARF has been persistent in asserting its broad claims of control over the use of stem cells in the US and its rights to reach through royalties on any products that result. WARFs ownership of these patents, which probably shouldn't have been issued (Geiger and Sá, 2008), have led to significant "costs in time, resources and harm to the public sector" (Golden, 2010, p. 323). While they certainly enrich WARF's and the UW's coffers, the patents also result in preventing more widespread use of stem cells for therapies (Golden, 2010), and create a situation in which stem cell research has been shipped overseas where US patents do not have legal effect (Geiger and Sá, 2008), thereby potentially undermining US scientific development.

Conclusion

The University of Wisconsin and its powerful TTO provide an instructive example of how the university as an institution continues to evolve with society. As the conditions in which the American university operates have changed and new opportunities have arisen, institutions like UW show their flexibility to adapt and take advantage, in this case through technology transfer initiatives and novel supporting structures. Kerr's definition of the multiversity is inclusive enough to allow for changes such as the commercial turn of many US universities evidenced by the increasing importance of technology transfer. It must be acknowledged too, that many of the issues involved in the emergence of powerful TTOs such as WARF can be traced back even further in the historical trajectory of the university as an institution. WARF was spontaneously created in much the same way as the original guilds of scholars that led to the creation of universities as institutions. Its emphasis of the practical uses of research run in parallel to the guiding mission of the German university model of the 1800s. The location of WARF, and of TTOs in general, on the fringe between science and industry make these entities symbols of the tensions that endure from the days of Cardinal Newman over the competing merits of knowledge for its own sake versus knowledge for the sake of direct social utility.

The multiversity envisioned by Kerr would appear to have room for TTOs, and he would perhaps be unsurprised by the emergence of such structures. However, questions might be asked about how powerful TTOs such as WARF might be skewing the balance of power between the many

internal communities of the university. A prolonged one-sidedness in the multiversity's war with itself may lead the institution down a dangerous path. Is it advisable for a TTO to have such a substantial influence over the research and hiring agenda of a university, as WARF now appears to have? Moreover, it is important to ask how comfortable we should be with the power that these entities may come to have in society more broadly. Growing on the edge of the university, WARF has used the fruits of government-funded research to build its own capacities to influence legislation that concerns it and even to alter the course of science in an emerging and highly important field in order to protect its financial interests. Perhaps we should be wary that the fuzzy edge of the university that interacts with society around it does not, in fact, turn out to be a mould.

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