Hard, soft, control: the 'technological triumvirate' of university-industry alliances

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Abstract

In the past few decades the university has increasingly exploited the commercial potential of select experimental data generated in its molecular biology research laboratories. The university protects such data with intellectual property (IP) rights, and licenses the use of this IP, or sells it outright, to the pharmaceutical industry. Such IP often details the discovery of a novel drug candidate that has potential to treat or cure human disease. Through my eyes as a university lab educator, I argue in this dissertation that the contemporary cultural trend of the university's sale of its research data to industry was catalyzed by two key concurrent events of late 20th century: a *knowledge economy* and *neoliberalism*. Utilizing technology as an analytical lens, I show that key *hard* and *soft* technologies gave rise to a *knowledge economy*; this provided the university with the prime technological platform for the heightened exposure, and conveyance, of its research data to industry. I argue that the contemporary political doctrine of *neoliberalism* is a *control* technology because it molds the public sector – including the university – into the competitive free market tendencies of the private sector; this

provided the university with the prime economic platform for the sale of its research data to industry. Moreover, I demonstrate that the university's sale of its select research data to industry has resulted in stronger alliances between the university and industry. Crucially, such alliances, I argue, have a profound impact on American higher education, on two levels: 1) the evolution of the university from a historic to a postmodern institution; and 2) fundamental changes in the nature of learning in the university research lab associated with the rise of the *postmodern university*. The dissertation concludes by considering various measures that may be used by the lab educator to mitigate these changes in learning in the *postmodern university* research lab.

List of acronyms

AAUP	American Association of University Professors
AT	Agency Theory
AUTM	Association of University Technology Managers
CJV	Curricular Joint Ventures
ICT	Information and Communication Technology
IP	Intellectual Property
IPA	Institutional Patent Agreement
IPR	Intellectual Property Right
IT	Information Technology
NDA	Non-Disclosure Agreement
NPM	New Public Management
OECD	Organization for Economic Co-operation and Development
PCT	Public Choice Theory
PI	Principal Investigator
R&D	Research and Development
TTO	Technology Transfer Office

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1

Introduction

The starting point for the dissertation is my employment in a research lab in a large hospital located in the American city of Boston. The hospital is a teaching hospital affiliated with the medical school of a major Boston university that, aside from serving patients from the greater New England area, functions as a practical teaching center for students attending the hospital's respective medical school. As is the case with many university medical school-affiliated teaching hospitals, the one in which I work has a large number of in-house research labs dedicated to understanding the underlying molecular mechanisms, prevention, and treatment of various human diseases.

A brief biography

My professional responsibilities in the research lab embody the dual role of 'lab researcher' and, in an entirely unofficial yet comprehensive capacity, 'lab educator'[1] (see later); the latter is the focus of the dissertation. During my tenure in the lab, our research funding was secured by the award of several substantial federal research grants, which enabled our lab to recruit more researchers. I was the one chosen to train these newcomers to our lab because of my desire – known at the time by my peers and my manager – to eventually make a transition from lab work, and to marry my passions for theoretical (as opposed to bench) science and education in a career that entails teaching science to undergraduate students in higher education, or perhaps training new scientists in industry. Coincident with this intensification of my pedagogical responsibilities in the lab, and in order to strengthen my teaching credentials to better market myself as an 'educator' proper to potential future employers in education, I applied to, and was subsequently successfully accepted to, Glasgow University's professional EdD programme.

Embarking on Glasgow's EdD programme in the fall of 2005 finally began to fill a troubling void in my resume: my lack of *formal* teaching accreditation or degree. Glasgow's EdD is a part-time professional degree program for working professionals engaged in all forms of education or training in all sectors. The EdD's almost exclusive online learning format, I quickly realized, freed me from what I perceive to be the burden, and even the artificialness, of on-campus lecture-theater-style teaching. My literal detachment of myself as a student from the physical school better enabled me to simultaneously integrate theory from the EdD programme into my professional practice, with the former providing rich insight, and in many ways informing, the latter. For example, various aspects of the EdD coursework raised my consciousness of, and consequently forced me to interrogate, the many taken-for-granted assumptions in my profession[2]. Many of these assumptions, some of which we will unpeel later in the dissertation, seem on the surface to erode the historically liberal and democratic ideals on which education has been built, and imbued in contemporary circles by the likes of John Dewey ([1916] 1997). The EdD programme and my complementary role as 'lab educator', coupled to my undertaking

[1] It is 'unofficial' in the sense that my responsibilities as a 'lab educator' are not included in my job description for 'Research Associate'.

[2] As inspired by Brookfield's 'hunting assumptions' in his book *Becoming a Critically Reflective Teacher* (1995).

a second job in 2009 as a part-time instructor in microbiology at Cambridge College (in Massachusetts), cemented my role as a science educator 'proper'. I was finally on a trajectory to one day depart the lab bench and embark on a full-time career as a science educator.

My professional responsibilities as a 'lab educator' entail my training newcomers to the lab on the theory of, as well the various practical techniques and methodology required to execute, our lab's research focus[3]. In this role, I *guide* my students into an 'adult-centered learning' experience that loosely reflects the theories originally developed, according to O'Sullivan (2004; cited in O'Neil & McMahon, online resource[4]), by Hayward in 1905 and Dewey in 1956. Nowadays, Carl Rogers (1983) is credited with expanding his theory of client-centered counseling into a theory of education, which was subsequently theoretically built upon by the works by Malcolm Knowles and Jean Piaget (O'Neil & McMahon). In this sense – as an educational *observer* more than a *doer* – the dissertation is not so much a report on my teachings as a lab educator as it is a report on my experiences of the learning dynamics among my students (or *peers*) in the university research lab, within the wider context of the contemporary university. I say 'learning', as opposed to 'teaching', because it best reflects the unstructured and often networked nature of informal knowledge exchange that typically occurs among my peers in the university research lab. 'Knowledge exchange' refers to the exposure of the lab researcher[5] to scientific research data, which I propose is of two primary types: *internal* and *external research data*. Crucially, *internal research data* lies at the heart of the many contentious issues explored in the dissertation. Therefore, characterization, including an introduction to ownership, of *internal research data* – and how it is distinct from *external research* data – is necessary for outlining the central argument of the dissertation.

[3] The research focus concerns the molecular characterization of a family of human cell surface receptors that are hijacked by certain viruses for entry into (and subsequent replication in) human host target cells. Advancing our understanding of these human cell surface receptors enables scientists to better understand how to block their hijacking by viruses, and thereby halt viral replication and consequent disease in infected humans.

[4] Available at: http://www.aishe.org/readings/2005-1/oneill-mcmahon-Tues_19th_Oct_SCL.html (last accessed 7/29/2012.

[5] Used here to refer to postdoctoral research fellows – the primary researchers of the university research lab – but extended to include PhD students, summer students, and research technicians, who are all potentially capable of independently executing lab research.

At the heart of the matter: internal research data

First, *external research data* is so-called because it is produced by all other universities and other academic institutions *external* to (and perhaps in competition with) the university in question[6]. *External research data* is primarily acquired by the university lab researcher from reading scholarly, often peer-reviewed, research articles published in journals that are centrally downloadable from online journal databases[7]. Access to these research articles, which contain invaluable research data, as well as accompanying experimental methodologies, scientific hypotheses and academic discussion, is crucial for helping the lab researcher – working in the context of the current competitive internet-driven pace of scientific research – to keep apace, understand, and even provide inspiration for, their own (and in turn, that of their lab's) ongoing research endeavors. This is especially so when one considers that research articles become instantaneously available to a *global* academic audience in light of the rapidity of the internet[8] – a quality that is magnified by the frequent publishing turnaround of research journals; the multiplicity of scientific topics and sub-topics that they encompass; and the large number of articles published in each issue of a research journal.

External research data is ultimately and unequivocally 'private'[9] because the journals in which it is published are often owned and controlled by publishing companies (see Goldacre, 2011; Monbiot, 2011[10]). However, it is important to realize

[6] For example, in the current professional context my lab publishes its research articles with its corresponding university affiliation on every article. So in the eyes of my employer, *external research data* is that which is published by any school other than itself.

[7] The primary online bibliographic database of scholarly articles published in life sciences and biomedical journals and used globally by researchers like myself, as well as medics, is PubMed (http://www.ncbi.nlm.nih.gov/PubMed/ - last accessed 7/29/2012). PubMed, which is ultimately maintained by the Unites States National Institute of Health (NIH), allows users to search specific articles by author, journal, volume number, keywords, etc. Despite the highly privatized nature of the articles archived by PubMed, users can freely obtain unlimited article publication details (title, date, volume, issue number, etc.) and almost always an abstract for all articles. Upon finding a specific article in PubMed, a user can click a link for redirection to the journal website of the article in order to purchase the article, or to access it for free by logging on with an institutional username and password. An equivalent and common bibliographic database of scholarly articles published in social science and philosophy journals, with similar functionality to PubMed, is ERIC – the Education Resources Information Center, which is ultimately maintained by the United States Department of Education.

[8] Aside from a potential several month delay in publication of a research article in a journal as a result of the peer review process (assuming a given article is accepted for publication, either conditionally or unconditionally, by the editor of the journal in question). Articles become instantly available to a global scientific audience assuming that: 1) the audience has unrestricted institutional access to journals as provided by their university, which tends to be the case, at least in contemporary academic institutions; and 2) there is no internet congestion issue associated with downloading articles.

[9] Aside from *Open Access* journals, the online content of which is unequivocally free for everyone; see: http://www.biomedcentral.com/info/about/charter/ (last accessed 7/29/2012).

[10] On the highly privatized nature of scholarly research journals and their tight control by the publishing companies that own them, see these brief articles in the Guardian, available online at: http://www.guardian.co.uk/commentisfree/2011/sep/02/bad-science-academic-publishing and http://www.guardian.co.uk/commentisfree/

that access to the vast majority of these journals, in the current professional context, is generally 'public' to the university lab researcher (but *not* the university per se) insofar as the university grants to its staff, for research and learning purposes, unrestricted public access to these journals via institutional subscription to them.

In contrast, and more relevant to the dissertation, *internal research data* is so-called because it is produced internally – 'in house' – by the lab in question[11]. *Internal research data* is primarily acquired by attendance of the lab researcher at mandatory meetings arranged by their own lab. 'Lab meeting' is often a weekly or bi-monthly event that entails one lab researcher, on a rotating schedule, reporting her most recent research findings to the entire lab[12]. Lab meeting, and the *internal research data* presented therein, is a rich educational process for all parties involved: the researcher presenting gains invaluable feedback from peers and the lab principal investigator on experimental troubleshooting and future directions for their project; her peers listening to the talk, because they work in the same lab and within the same specialized research focus as the person presenting, often gain fresh ideas for their own research directions.

With this in mind, *internal research data* is invariably 'public' to the members of the lab that produced it[13], and continues to be after publication[14], because it is produced by the lab, and is intended for the lab's ongoing research purposes. At the point of publication, *internal research data* flows into the *external research data* pool. As *external research data*, which is technically private, it becomes public to all those lab researchers whose academic institution grants to them free access to it.

2011/aug/29/academic-publishers-murdoch-socialist (last accessed 7/29/2012).

[11] In the current professional context, I consider any data generated by myself or my peers, or by any other lab in our university hospital, as *internal research data*.

[12] *Internal research data* can also be acquired by the informal sharing of research data among peers from a given lab.

[13] Invariably, *internal research data* is public, until publication, to *just* the lab that produced it (unless it is a collaborative research effort involving two or more labs) as to avoid competitors (academic or corporate) gaining intellectual foothold on a particular common research project, goal, or discovery, that all parties are competing towards. However, this statement is a generalization as many researchers break from this rule when they openly present their data at global conferences or at other venues. This often occurs, for example, when the lab researcher's data is close to the point of being rendered 'open knowledge' because its publication is imminent, or when a lab researcher wants to gain fresh intellectual insights into their research from a broader audience.

[14] Publishing research data in scholarly journals, it is fair to say, is a primary academic goal of the lab (in distinction from humanitarian motives to find cures that treat human disease, e.g.). The promotion of the lab principal investigator up the professorial ladder is highly dependent on the quantity and quality of published research articles (often their name appears last as senior author on the author list). Likewise, a primary goal of the lab researcher is to publish as many research articles as possible (with their name ranking first on the author list, or somewhere in between first and last names, depending on their intellectual and/or practical contribution to the study in question).

Unless, that is, a given piece of *internal research data* is privatized by the university as intellectual property (IP)[15], prior to its publication, then the data and use of it comes under the exclusive private ownership of those that own the patent rights to it.

In the eyes of the university, *internal research data* has potentially greater *commercial* value over *external research data* for two reasons. First, *internal research data* represents knowledge that is entirely novel and, as a consequence, has likely not been subject to prior commercialization. Second, *internal research data* is usually only known by the university research lab that generated it. Such exclusivity helps assign IP ownership of a given *internal research data* to the lab that generated it, more so than if the data were *external research data*, because ownership of the latter, which is available to a global audience in online journals, is likely highly contestable. The university, in the past few decades in particular, has increasingly exploited the commercial potential of select *internal research data* by protecting it with IP rights, and subsequently licensing the resulting IP to industry. The university sells to industry lucrative *internal research data* that, for example, demonstrates the discovery of (or technology required to develop) a novel drug that has potential to treat or cure human disease[16]. This practice by the university sets the scene for the central argument of the dissertation.

Utilizing a lens of technology, the central argument of the dissertation is that the contemporary cultural trend of the university's sale of its *internal research data* to industry was catalyzed by two key concurrent events of late 20th century: a *knowledge economy* and the political doctrine of *neoliberalism*. I show that the university sale of its select *internal research data* to industry has resulted in stronger alliances between the university and industry. Crucially, such alliances, I will argue, have a profound impact on American higher education on two levels: 1) the evolution of the university from a historic to a *postmodern* institution; and 2) fundamental changes in the nature of learning in the university research lab associated with the rise of the *postmodern university*. The next and last section of this chapter outlines how I will make these arguments.

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[15] IP is a legal field granting proprietorship to a person or people of knowledge intangibles. For the time being, IP may be mediated by *copyrights*, which protect literary and artistic works; *trademarks*, which protect names and logos; and *patents*, which protect discoveries and inventions. Patents invariably protect *internal research data* generated in the university research lab.

[16] The ultimate goal of industry is the commercialization of novel pharmaceuticals – a multitrillion-dollar business; see interest group Public Citizen's publication *2002 Drug Industry Profits: Heft Pharmaceutical Company Margins Dwarf Other Industries* at: http://www.citizen.org/documents/Pharma_Report.pdf (last accessed 7/29/2012).

Dissertation synopsis

Chapter 2 – *The Hard, the soft, and the ugly: the multiple faces of technology* – provides the conceptual backbone for the dissertation. Here, I delineate three common types of technology that characterize today's contemporary society: *hard*, which have a physical manifestation (e.g., the personal computer); *soft*, which do *not* have a physical manifestation (e.g., wireless internet); and *control*[17], which also do *not* have a physical manifestation, are ultimately mediated by social psyche, and are designed to implicitly control the individual to perform in a particular way (e.g., an online advertisement enticing the consumer to purchase a university degree program).

Chapter 3 – *Hard and soft technologies: birth of a knowledge economy* – borrows from my technology concepts in Chapter 2 to argue that the emergence of certain key *hard* and *soft* technologies in the latter half of the 20th century provided the university with the prime technological platform for the heightened electronic conveyance of its *internal research data* to industry. This (and other forces) contributed to the emergence of a *knowledge economy* that, for the time being, may be defined as a prominent economic order characterized by the abundant global production and sale of knowledge.

Chapter 4 – *Neoliberalism as a control technology* – borrows from my technology concepts in Chapter 2 to argue that the contemporary political doctrine of *neoliberalism* is, relative to its predecessor classical liberalism, a *control* technology. It is a *control* technology because it controls, to the strategic advantage of the state, the individual and the public sector to conform to a free market order that is the embodiment of capitalism. Crucially, I show how neoliberalism provided for the university a prime economic platform for the sale of its *internal research data* to industry.

Chapter 5 – *Hard, soft, control: the 'technological triumvirate' of university-industry alliances* – argues that the *hard* and *soft* technologies of a knowledge economy, and the *control* technology of neoliberalism, collectively catalyzed the necessary conditions for the university to forge novel business ties with industry. The prototypic example of this, in a neoliberal era of university entrepreneurialism, is the university seeking alternative revenue through the patenting of its *internal research*

[17] Throughout the dissertation, for the sake of simplicity, I say that 'neoliberalism is a *control* technology', which I realize inaccurately grants moral agency to an otherwise amoral entity (see Poole, 2005). When I say that 'neoliberalism is a *control* technology' I ultimately refer to the politicians and policymakers of neoliberalism who are the ultimate *control* technology.

data, and the subsequent licensing of this IP to industry by a process called *technology transfer*.

Chapter 6 – *Local to the global: the changing face of the 'university'* – explores the rapidly evolving nature of the university as shaped by technology transfer and the attendant forces of neoliberalism and globalization. I explore the concept of the *corporate university* that refers to the radical quasi-corporate business practices employed by many universities in order to remain competitively cutting-edge in a neoliberal free market economy. I show that technology transfer – ultimately born from the *hard* and *soft* technologies of a knowledge economy, and the *control* technology of neoliberalism – erodes the public sphere of the university; this encroachment, I will argue, is key to conversion of the university from a historic to a *postmodern* institution.

Chapter 7 – *Global to the local: learning in the postmodern university research lab* – explores the epistemological nature of my students' learning concerning *internal research data* generated in the lab. Crucially, I assess how this learning is impacted by the broader switch in the university from a historic to a *postmodern* institution. Next, I present empirical data showing that the *technological triumvirate* of university-industry alliances is responsible for the rise in 'cultural changes' in the university research lab – namely, heighted secrecy among lab researchers, and industry-imposed university publication delays. The impact of such cultural changes on learning in the university research lab is assessed.

Lastly, Chapter 8 – *Back to the future* – begins with a summary of the central arguments of the dissertation. From this summary, we extract and deconstruct a central theme of the dissertation in order to tackle a troubling contradiction that characterizes learning and research in the *postmodern university* research lab. That is, the clash of free and open science that exemplified lab research as conducted under classical liberalism with the more controlled research conditions that arise under neoliberalism. We close this chapter, and indeed the dissertation, with a look at some of the possible ways I can reconcile this contradiction in the current professional practice.

2

The hard, the soft, and the ugly: the multiple faces of technology

> By the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short we are cyborgs. (Haraway, 1996: 465)

Donna Haraway succinctly highlights the extreme social pervasiveness of modern technology in contemporary society. Not only have humans become increasingly immersed in technology (e.g., cars, computers), but also literally fused to various forms of technology (e.g., pills, prosthetics), creating what some scholars refer to as the 'cyborg' – a portmanteau of *cybernetic organism*[18]. Couple technology's social pervasiveness to

[18] Aside from this somewhat superficial (albeit correct) definition, 'cyborg' is a more sophisticated metaphorical tool coined by Haraway (1996) that she uses to reconcile many dualisms she blames for disparities

its seemingly magic ability to manipulate, as in virtual technology, time and space dimensions, and one may start to appreciate that the implications of technology for humanity – education included – are profound. But before we begin to explore the actual implications of technology for education in the current professional context, the term needs some delineation.

Technology: a historical whirlwind

Franssen *et al* (2009) trace the history of the philosophy of technology to ancient Greece where they highlight four major themes at play during that era:

First, is the theme that technology is inspired by nature (Plato, *Laws* X 899a ff.), such as Democritus's example of house building that was thought to be modeled on birds building their nests.

Second, is the ontological distinction between natural and human-made things, with the former being dynamic, self-replicating entities that are formed from within, in contrast to the latter being static, non-replicating entities that are formed by external means.

Third, is Aristotle's doctrine of the four causes – material, formal, efficient, and final (*Physics* II.3). Aristotle's four causes form the backbone of Martin Heidegger's essay *The Question Concerning Technology* (1977), which I shall probe shortly.

And fourth, is the comprehensive utilization of technological imagery drawn from the arts and crafts used by both Plato and Aristotle in their philosophical works.

Moving on from ancient Greece, Franssen *et al* (2009) note that despite significant technological advance in the Roman empire and during the Middles Ages, more attention was given to the practical, rather than the philosophical, aspects of technology. It was not until the Renaissance that a philosophy of technology gained a greater appreciation, spurred by Francis Bacon's utopian novel of technological reflection called *New Atlantis* ([1627] 2009). The book garnered a positive response lasting well into the 19th century and the first half-century of the industrial revolution. It was not until the publication of Samuel Butler's book *Erewhon* ([1827] 2008), a story about a country in which machines are banned in order to avoid a potentially

among traditional feminists, as well as to assist in her feminist critique of capitalism. In addition, Haraway looks to technology as a means of reduction of gender differentiation.

machine-dominated society, when technology was cast, for the first time, in a more sociocultural light (Franssen *et al*, 2009).

Finally, the authors note that toward the end of the 19th century and in most of the 20th century, a critical turn in philosophy arose that was shaped by scholars largely from the humanities and social sciences, notably Heidegger (1962, 1977, e.g.), Jonas (1985, e.g.), Feenberg (1999, e.g.), and Latour (1996, e.g.), in the context of technology research. This field is what Carl Mitcham (1994) refers to as 'humanities philosophy of technology'. However, since the 1960s it has largely been surpassed by a more analytic philosophy of technology that is concerned with technology itself, as opposed to the social interplay between technology and society. It is the latter kind of philosophy of technology that I remain with to now probe what is regarded as one of the more significant and contemporary contributions to the field of philosophy of technology: Heidegger's *The Question Concerning Technology* (1977)[19].

Heidegger on technology

It seems that any theoretical inquiry on technology should not be undertaken without some prior acknowledgement of Heidegger's (1977) contribution to the philosophy of technology. Indeed, Godzinski (2005; online resource[20]) states that 'with few possible exceptions, Heidegger is arguably one of the first philosophers to explicitly discuss the implications of a philosophy of technology'[21]. Heidegger's *The Question Concerning Technology* (1977) is a phenomenological inquiry that fundamentally centers on the human state of 'being' and how, in the context of the current inquiry (Heidegger, 1977), this state comports with technology. For Heidegger, the human state of 'being' is the state when things reveal to us their (otherwise) concealed truth, or 'essence'[22]:

[19] The following online resources assisted me with some of my interpretive analysis of Heidegger's *The Question Concerning Technology* (1977): http://www.english.hawaii.edu/criticalink/heidegger/index.html (last accessed 10/4/2009); and http://www.optdesign.com/Philosophy/Heidegger2.htm (last accessed 7/29/2012).

[20] Available at: http://commons.pacificu.edu/eip/vol6/iss1/9 (last accessed 7/29/2012).

[21] Godzinski (2005) believes that *The Question Concerning Technology* (1977) and *The Turning* (1977) represent the embodiment of Heidegger's work on the philosophy of technology, despite noting that some scholars believe that Heidegger's critique of modern technology may be found in a more rudimentary form in his magnum opus *Being and Time* (1962).

[22] Later in his inquiry, Heidegger (1977: 29) explains to the reader that essence means '*what* something is; cited in Latin, *quid*. *Quidditas*, whatness' (original emphasis).

> we shall be questioning concerning technology, and in doing so we should like to prepare a free relationship to it. The relationship will be free if it opens our human existence to the essence of technology. (Heidegger, 1977: 3)

Heidegger (1977) employs an etymological approach to dissect the meaning of several terms from Greek philosophy in order to build an ontological argument that concerns, not so much the existence of technology per se, but rather humans' fundamental attitude towards it. In doing so, Heidegger (1977) challenges, and in the course of his inquiry transcends, what he sees as the inadequate definition of technology as merely a means/end, and notes that this 'instrumental definition of technology [albeit correct] still does not show us technology's essence' (Heidegger, 1977: 6). Such inadequacy leads Heidegger to a discussion on 'causality'. Heidegger (1977) uses the example of a silver chalice to demonstrate how it, and premodern technology in general, derives from the four Aristotelian causes: material (silver); formal (shape of the chalice); final (the specific intended purpose of the finished chalice as a sacrificial vessel, which together with the material and formal causes, is responsible for the chalice being a chalice); and efficient (the silversmith). Each of the four causes, according to Heidegger (1977), is *coresponsible* for 'bringing-forth' the chalice, which is already 'on its way', into being. Indeed, Heidegger's repeated reference to the chalice as a 'sacrificial vessel' could not be a more poignant pointer to, not just the sacrifice of Christ, but to the four causes that 'sacrifice themselves' to bring-forth the chalice into existence. Waddington (2005: 569) notes that

> bringing-forth is not merely a descriptive genus under which the four causes are subsumed – rather, it is a unified process, "a single leading-forth to which [each of the causes] is indebted" (Lovitt, 1972: 46).

So the four causes do not so much create the chalice than to *collectively assist* the potential chalice 'on its way' to being, or as Heidegger (1977: 11) puts it, 'bringing-forth brings hither out of concealment into unconcealment'. Heidegger (1977) highlights that such bringing-forth, or 'poiēsis' in Greek, is a form of 'revealing', the process of which he intimately ties to the four modes of causality. He then ties the notion of 'poiēsis' as a mode of revealing to the literal Greek word for 'revealing' that is 'alētheia', which means 'truth'.

With this foundation in place, Heidegger then moves on to examine the etymological lineage of the word 'technology', which he explains is derived from the Greek word 'technikon' that in turn is derived from 'techne'. Heidegger shows us that 'techne' may refer to: 1) the skills of a craftsperson (such as the silversmith) as well as those for the arts of the mind; or 2) more importantly, from Plato onwards, techne was often used in conjunction with the word 'episteme' – the branch of philosophy concerned with the nature and scope of knowledge. As both expressions of techne essentially convey a mode of 'revealing' – the bringing-forth of the silver chalice by the silversmith, and the bringing-forth of knowledge in the case of episteme – the actual *essence* of technology in the context of 'techne', Heidegger argues, may be conceived as a mode of 'revealing', and not the instrumental definition given earlier. As such, technology, according to Heidegger (1977), may be conceived as an expression of 'truth', as captured by the Greek word 'alētheia':

> Technology is a mode of revealing. Technology comes to presence in the realm where revealing and unconcealment take place, where *alētheia*, truth, happens. (Heidegger, 1977: 13)

But, according to Heidegger (1977), poiēsis as a mode of revealing is only applicable to premodern technology: modern technology, by contrast, has its own mode of revealing that Heidegger calls 'challenging-forth'. He juxtaposes an example each of premodern and modern technology – the windmill in the Black Forest and the hydroelectric power plant on the River Rhine, respectively – to show how they fundamentally differ:

> That revealing that rules in modern technology is a challenging, which puts to nature the unreasonable demand that it supply energy that can be extracted and stored as such [in reference to the example of the hydroelectric power plant]. But does this not hold true for the old windmill as well? No. Its sails do indeed turn in the wind; they are left entirely to the winds blowing. But the windmill does not unlock energy from the air currents in order to store it. (Heidegger, 1977: 14)

'*Challenging*-forth' as the mode of revealing for modern technology, then, suggests a phenomenon that is preceded by a greater and more strategic level of *proactivity* (e.g., proposition, planning, and/or production of the modern technology in question) by the craftsperson(s), over and above that for bringing-forth. Accordingly, I alternatively interpret 'challenging-forth' as a *proactive bringing-forth*. I further interpret that such

proactivity is by driven by a central *premeditation*[23] on the part of the craftsperson(s) that provokes them to actively *seek* (or 'set-upon'; Heidegger, 1977) and '*control* the productive processes' (Waddington, 2005: 569; original emphasis). Furthermore, 'proactive' in 'proactive bringing-forth' suggests that the 'efficient' cause (i.e., the craftsperson) is no longer a *co*-player in bringing-forth, but rather the *key* player, and, as such, a given craft is apparently not granted sufficient time to artistically materialize, or 'bring-forth'. Heidegger perceives objects in challenging-forth as a 'standing-reserve' – an endless source of raw material 'on call' and at the predetermined mercy of humans: 'the machine [an airliner] is completely unautonomous, for it has its standing only from the ordering of the orderable' (Heidegger, 1977: 17). Waddington (2005) highlights that objects rendered a standing-reserve are reduced to 'disposability' both in the 'technical sense' of the term – such as trees in a forest marked and quantified by humans for subsequent felling, transit, and sale – and in the 'conventional sense' of the term – as in trees in the forest being endlessly replenished by humans, and hence having little spiritual value.

'Technology': towards a definition

Hanson and Froelich (2005) state that philosophers, anthropologists, sociologists, historians, and teacher educators, nowadays all engage in the study of technology but a widely accepted definition for the field remains obscure. Similarly, Kroes (1998) states that the philosophy of technology as a coherent field of research does not exist yet and that technology's multidisciplinary nature, which draws from many diverse schools of philosophical thought, obfuscates a primary definition for the field. Nevertheless, Heidegger (1977: 4) provides a definition for technology, albeit 'concealed', as 'the manufacture and utilization of equipment, tools, and machines,

[23] Crucially, this premeditation lies at the heart of Heidegger's (1977) concept of 'challenging-forth' and is inextricably tied to monetary motives on the part of the planners of the modern technology in question, given Heidegger's (1977) repeated connotative references to consumerism and/or economic efficiency – inextricably tied to examples of 'challenging-forth' – throughout his essay. For example: 'Agriculture is now the mechanized food industry' (p15); 'toward driving on to the maximum yield at the minimum expense' (p15), in reference to 'challenging-forth', which uncannily sounds like Lyotard's (1984) 'performativity' thesis of knowledge legitimation in postmodern society; 'The Rhine … an object on call for inspection by a tour group ordered there by the vacation industry' (p16); and, 'The forester … is today commanded by profit-making' (p18). Indeed, Heidegger (1973) in an earlier work criticizes consumerism: 'The circularity of consumption for the sake of consumption is the sole procedure which distinctively characterizes the history of a world which has become an unworld.' (Heidegger, 1973: 107; cited in *Dreyfus & Spinosa*, 2003: 340).

the manufactured and used things themselves, and the needs and ends that they serve'. Similarly, Kroes (1998, online resource) gives what seems like the nowadays common conception of technology as a

> transformation or manipulation of nature (the existing physical (material) and biological environments) to satisfy human needs and goals. Technology is thus conceived to be a specific form of purposeful (teleological) action that may result in a technological artifact: a human-made object or state of affairs that fulfills a utilitarian or practical function[24].

This conception of technology, Kroes notes (1998), is not without its shortcomings. Namely, on the one hand, the definition may be too broad as it potentially renders any object or state of affairs that fulfills a practical or utilitarian function a 'technological artifact' (with the example given of a tree planted in a specific location to provide shade). On the other hand, the definition may be too narrow to encompass technologies that are essentially immaterial, such as software engineering. Nevertheless, Schoffner *et al* (2000: e-journal) conceptualize the notion of technology to include immaterial technologies that they collectively term 'soft technologies', and which they define as 'having no hardware at all ... and focus [in the context of education] on theories of learning'. These contrast with technologies that actually have some form of material existence, which Schoffner *et al* (2000: e-journal) collectively term 'hard technologies', and which they define as being 'made of matter or, more recently, things that plug in'[25].

I neither side with nor contest any one of the above definitions because that would seem to pigeonhole 'technology', and thereby sever this complex concept from my further discourse and debate. Indeed, Enslin (2010: 1), on the role of definitions in the philosophy of education, notes that

> a short definition will inevitably be contestable: so complex are many issues in education and other fields that, while a working definition or initial characterization may, sometimes, serve to get a discussion going – probably for later reformulation –

[24] Indeed, the notion of technology as a potentially social and immaterial entity is neither a new notion, nor is it exclusive to Kroes (1998). For example, Finn says that 'in addition to machinery, technology includes processes, systems, management and control mechanisms both human and non-human' (1960: 10), whilst Olssen (2001: 37) states that 'neo-liberal technologies' effect is a new form of power which systematically undoes and reconstructs the spaces of classical liberalism'.

[25] See also Burgess and Gules (1998) who present a likeminded 'hard/soft technology' nomenclature in their paper about advanced manufacturing materials.

> a considered account that grapples with conceptual and other complexities is likely to be required.

Accordingly, I draw on elements of the above definitions of 'technology' and use them together with my preceding discussion on Heidegger in order to formulate my *technology concepts framework* that will serve as the conceptual backbone of the dissertation. However, consistent with Enslin (2010), these are not closed concepts; rather, they are *fluid* concepts – what I like to call 'offerings' – that are open for further contestation, deliberation, and modification. It is these offerings that we now turn to.

'Technology': conceptual offerings

My use of the gerund 'technologizing' later in the dissertation is intended to evoke in the reader a twofold meaning: 1) a sense of 'technological permeance' in advanced contemporary society, as exemplified, for example, by the notion of the 'cyborg' (see, e.g., Haraway, 1996); and 2) a continual state of 'technological advance' in advanced contemporary society that is more dynamic sounding – past, present, future – than the adjective 'technolog*ical*', which sounds stuck in time. Moreover, the chronologically-dynamic sound to this second meaning of 'technologizing' enables my use of both historical and futurist research lenses in the dissertation. But as I have yet to deploy my historical lens to retrospectively probe the concepts of a knowledge economy and neoliberalism, my notion of 'technologizing' will probably only become appreciated by the reader upon reading the dissertation in its entirety. For the meantime, I now set out to build the case that advanced contemporary society is 'technological':

First, consistent with the common definition of technology provided by Kroes (1998), and borrowing from and building upon the technology concepts of Schoffner *et al* (2000), technology may be conceived as *hard*. I further propose that 'hard technologies' are 'inorganic' in the sense that they consist solely of non-human parts[26]. Fundamentally, *hard* technologies exhibit an immediate physical manifestation and include, in the context of learning in the lab, the personal computer

[26] But may, nevertheless, be *fused* to them, such as, for example, dental amalgam fused to the cavity of a decayed human tooth, or a prosthetic hip joint fused to a human femur bone in the case of a hip replacement.

(PC) and the Geiger counter (an instrument, with a distinctive 'croaking' sound that measures ionizing radiation in the immediate environment). Finally, and contrary to Schoffner *et al* (2000), not all *hard* technologies necessarily 'plug in': some *hard* technologies, like the Geiger counter, may be powered by mobile electrical sources like batteries, while other *hard* technologies, like the solar-powered scientific calculator, may be powered self-sufficiently so by the sun's light energy.

Second, consistent with the common definition of technology provided by Kroes (1998), and borrowing from and building upon the technology concepts of Schoffner *et al* (2000), technology may be conceived as *soft*. I further conceive that 'soft technologies' are 'inorganic' in the sense that they, too, comprise solely non-human parts. Fundamentally, *soft* technologies do not apparently exhibit any immediate physical manifestation in the way that *hard* technologies do and, I conceive, are the 'signal' that *hard* technologies send and/or receive that is fundamental to their functioning[27]. *Soft* technologies include, in the context of learning in the lab, and as the cognate *soft* technologies of the two *hard* technology examples given above, the internet that is *sent* and *received*, and processed, by the PC, and radioactivity that is *received* – or *detected* – and processed by the Geiger counter. The internet (and its cognate *hard* technology that is the PC) impacts learning in the lab because it has the potential to convey copious quantities of beneficial knowledge to the researcher that may assist her learning. Meanwhile, radiation impacts learning in the lab because its intentional and controlled use by researchers allows them to visualize otherwise invisible (due to their atomic size) proteins as scorched bands on X-ray film because radiolabel-tagged proteins 'burn' X-ray film. That way, researchers gain insights into the molecular properties of proteins, which in turn is important for gaining insights into human diseases.

Third, consistent with the common definition of technology provided by Kroes (1998), and consistent with the potential 'control' dimension that Finn (1960; see

[27] Despite acknowledging, and accepting, the broader definition for '*soft* technology' provided by Schoffner *et al* (2000) that includes the likes of, for example, theories of teaching as well as computer software, I restrict my definition here because it has most relevance and significance for subsequent arguments.

footnote 24) ascribes to technology, technology may be conceived as *control*[28]. McDermott likemindedly notes that

> technology, in its concrete, empirical meaning, refers fundamentally to systems of rationalized control over large groups of men [or women], events, and machines by small groups of technically skilled men operating through an organized hierarchy. (McDermott, 1981: 142).

With this foundation in place, and building upon my earlier refinements of the technology concepts of Schoffner *et al* (2000), I conceive that *control* technologies are 'organic' in the sense that they *ultimately* manifest as a mediating 'human *hard* technology' (i.e., a human being; or more fundamentally, a human brain[29]) in addition to a mediating cognate 'human *soft* technology' (i.e., human or social psyche[30]). *Control* technologies, although organic, clearly have potential to be rendered into an inorganic '*hard* and/or *soft* technology' format, such as a university official (the 'controller') circulating an email memo (mediated by both the inorganic '*hard* technology' of the PC and its cognate '*soft* technology' that is the internet) enforcing a new policy that exerts some means of 'control' over faculty members. The 'human' prefix to these 'human *hard*/*soft* technology' coinages denotes their inherently organic makeup. As such, 'human *hard*' and 'human *soft*' technologies are distinct from, but at the same time relate to, my earlier notion of '*hard*' and '*soft*' technologies[31].

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[28] Indeed, my satirical use of 'ugly' in the title of this chapter is a reference to *control* technology; we will see in Chapter 4 why *control* technologies are ugly.

[29] But one might argue that this can be expanded to include, for example, human body parts like arms and hands in the case of a human physically assaulting, and hence controlling, another human. However, it is the human brain that is the ultimate *control* technology because it is the very brain of the 'controller' that cognitively conceives the notion to assault the 'controlled' in the first place. Such is an example of a 'physical *control* technology' whereby the 'controlled' is/are *physically* controlled, in contrast to a 'mental *control* technology' whereby the 'controlled' is/are *mentally* controlled, as in, for example, political ideology, propaganda, persuasion, or coercion. Mental *control* technologies may be further subcategorized into either: 'unconsciously-mediated' (i.e., the 'controlled' is/are largely *incognizant* of being controlled), as, we will see, in the instance of neoliberal governance; or 'consciously-mediated' (i.e., the controlled is/are largely *cognizant* of being controlled)', as in the instance of a patient knowingly being hypnotized by a hypnotist. However, the dissertation primarily conceives, and concerns, *control* technologies as largely 'mental *control* technologies' of the 'unconsciously-mediated' kind (hereafter referred to as just '*control* technology'). Further, this notion of *control* technology, first and foremost, affects human *psyche* (hence the designator 'mental') with the potential to subsequently affect human *behavior* when the 'controlled' actually *act upon* affects to their psyche brought about by *control* technologies.

[30] Perhaps not limited to humans; *control* technologies may also be active in the wider animal kingdom as in the luring, hence control, of prey by predators. One might argue that the plant kingdom also exhibits use of *control* technologies, as in the case of carnivorous plants, for example, such as the venus fly trap that traps flies in its hinged leaves to digest them for food. However, I counter such a notion on the basis that plants entirely lack any form of conscience.

[31] Unless we comprehend *hard* and *soft* technologies in a *control* technology light, the 'human *hard/soft* technology' label is necessary to reject the notion that *hard* and *soft* technologies may, too, control human behavior. However, I counter-argue such a notion on the basis that *hard* and *soft* technologies do not *consciously* do so with a specific means/end. For example, the *hard* technology of the Ford assembly line of early 20th century controlled humans to work in a very specific fashion within a very specific timeframe. But, it is the 'human

Control technologies, I conceive, should ultimately influence, affect, modify, comply, or conform, for example, the mental (and ultimately physical) faculties of those 'controlled' – an act that would seem to represent the desired means/end goal of the 'controller' (i.e., the '*control* technology'). Furthermore, as we will see in Chapter 4 in the case of neoliberalism, *control* technologies often get institutionalized as the modus operandi. I now incorporate my notion of *control* technologies onto Kroes' (1998) definition of technology to demonstrate how they complement one another (my additions are emphasized, and within square parentheses):

> transformation or manipulation of nature (the existing physical (material) [*the 'human hard technology' that is the brain*] and biological environments [*the 'human soft technology' that is psyche*] to satisfy human needs and goals [*'external control technologies' like wider political ideology, or 'internal control technologies' like institutional policy, e.g.*]). Technology is thus conceived to be a specific form of purposeful (teleological) action, that may result in a technological artifact: a human-made object or state of affairs ['*controller(s)' controlling the 'controlled'*] that fulfills a utilitarian or practical function [*conforming human behavior with a specific means/end goal, such as neoliberal government's (the 'controller') fashioning its citizens (the 'controlled') into free-market entrepreneurs; see, e.g., Peters, 2001b; Davies & Petersen, 2005*].

Fourth, and finally, in line with Heidegger's (1977) conception of the essence of modern technology, I propose that neoliberalism reveals its essence as Heidegger's 'challenging-forth'. I validate this claim in four ways:

First, Kroes (1998, online resource) states that technology 'fulfils a utilitarian or practical function'. The potentially ambiguous nature of such a statement, I suggest, invites technology to potentially be conceived as '*control*', as I have demonstrated with my molding of Kroes' definition of technology to fit with my notion of '*control* technology'. '*Control*', in turn, is a term laden with planning or premeditation – a notion that inextricably ties to my reconception of challenging-forth as a 'proactive (i.e., *premeditated*) bringing-forth'[32].

Second, I earlier argued that humans (more specifically their psyche) *are* the *control* technology in question. Indeed, in his example of the hydroelectric power plant, Heidegger (1977) casts humans in the context of human activity that precedes

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creator' (i.e., the 'human *hard/soft* technology') of the assembly line that is the ultimate *control* technology – not the assembly line per se.

[32] There is no denying that Heidegger's (1977) conception of the windmill as an example of ancient technology was also designed and built by humans, like the hydroelectric power plant, with a certain degree of premeditation (i.e., to provide electricity), which would seem to invalidate this argument of mine. However, I stress that the extent of premeditation along the lines of *consumerism* (see footnote 23) in the case of the hydroelectric power plant is far greater – especially in the context of today's consumerist culture and global capitalist market – than that for Heidegger's (1977) conception of the windmill.

(and essentially gives rise to) the phenomenon of challenging-forth, in a greedy, and conceivably controlling, light: 'the *unreasonable demand* that it [nature] supply energy that can be extracted and stored' (Heidegger, 1977: 14; my emphasis). Such language, especially when juxtaposed to Heidegger's (1977) seemingly romanticized notion of wind-generated power suggests, on the part of the planners of the material technology that is the hydroelectric power plant, a *premeditation* to ultimately provide electricity to the masses and, perhaps, to control that market, and reap profit in the process. Such consumerist premeditation is invariably driven by a '*means/end efficiency*'[33] that defines the sociologically rationalizing nature of today's world (see, e.g., Ritzer (2007) who draws on Max Weber (2002) to build his thesis of the 'McDonaldization of society'). Heidegger's (1977) hydroelectric power plant speaks of 'means/end efficiency' in the sense that fewer, scaled-up plants more efficiently provide energy to hundreds of thousands more consumers in a rationalizing society, compared to a higher number of relatively tiny and geographically dispersed windmills of a largely bygone era. Moreover, such 'means/end efficiency' seems particularly pertinent in light of today's globalizing world, its population demands, and the capitalist markets therein.

Third, the language of 'means/end efficiency' under this broad banner of globalization[34] sounds uncannily like the central driving force of the pro-globalizing political doctrine of neoliberalism[35]. But how does neoliberalism as a perceived *control* technology reveal its essence as challenging-forth? I argue that the human activity that furnishes a neoliberal agenda of any sort is laden, more so than the human activity that precedes technologies whose essence reveals as a bringing-forth,

[33] 'Efficiency' being a key word because it invites the reader into the notion of '*maximizing* the various outputs of a given system whilst *minimizing* the various inputs' – the exact same maxim that Heidegger uses in reference to 'challenging-forth' (page 15, 1977). For example, *maximizing outputs* may include 'employee productivity' in the case of not-for-profit entities like neoliberal governance, or 'profit' in the case of for-profit entities like industry; *minimizing inputs* may include 'operating costs' in the case of not-for-profit entities, or 'production materials' in the case of for-profit entities. But it is the minimizing input of 'operating costs' in the context of neoliberal reform of higher education that invariably comes at the cost of *controlling* these employees to rev up their productivity via 'install[ing] relations of competition as a way of increasing productivity, accountability and control' (Olssen & Peters, 2005: 326).

[34] 'Globalization' is used here and throughout the dissertation to refer to the more contemporary meaning of the word, as globalization is not a new phenomenon; see, for example, Harvey, 2000.

[35] For neoliberalism as a driver of globalization, see, for example, Torres and Schugurensky, 2002; Basu, 2004; Hursh, 2004; and Olssen and Peters, 2005. Also, given that I make a connection between consumerism and means/end efficiency, and I just now state the means/end efficiency of neoliberalism, I, in doing so, essentially connect neoliberalism with consumerism. This is a justified move because neoliberalism espouses free-market capitalism, which drives consumerism, in addition to it driving marketization of the public sector, including higher education and healthcare, rendering these sectors more consumer-driven. Indeed, Olssen (2001: 50) notes that 'it [neoliberalism] commodifies everything including knowledge and cultural identity'. For more on neoliberalism as a decidedly consumerist enterprise, see, for example, Liu, 2007; and Giroux, 2009.

with a greater degree of *premeditation* that is driven by a means/end efficiency desire on the part of the controllers (e.g., politicians, policymakers) of a neoliberal agenda. This is demonstrable by juxtaposing neoliberalism with its predecessor, classical liberalism. For example, classical economic liberalism represents a *negative* conception of state power wherein autonomous individuals function with minimal state intrusion; neoliberalism, on the other hand, represents a *positive* conception of state power wherein individuals are implicitly engineered by the state as competitive auto-regulatory entrepreneurs (Olssen, 2004). The individual in classical liberalism is perceived as an egoistic, rational utility-maximizer and, accordingly, labeled *Homo economicus*; a label that is warped under neoliberal ideology into what Olssen *et al* (2004: 137) call 'manipulable man'. Hence, such characteristics suggest that neoliberalism is laden with human premeditation that is driven by means/end efficiency manifesting at: the *personal level* via 'responsibilising the self' (Peters, 2001b); the *national level* via marketization of the public sector through, for example, 'new public management' (Peters, 2001a); as well as the *international level* via pro-free trade agreements (Olssen & Peters, 2005).

And fourth, Heidegger (1977) uses his concept of 'standing-reserve' in exclusive reference to his concept of 'challenging-forth' (they go hand-in-hand). I therefore conceive that *those controlled* by the controllers under neoliberalism are instrumentally reduced to a mere 'standing reserve', or a 'means' to a desired 'end'. Indeed, Lipman (2004: 179), speaking in the context of neoliberal-motivated US urban school reform, notes that 'teachers are reduced to technicians and supervisors in the education assembly line – 'objects rather than subjects of history'. And even Heidegger (1977: 18) does not deny that technology, to a degree, reduces humans to a standing-reserve: 'The forester … is today commanded by profit-making in the lumber industry, whether he knows it or not. He is made subordinate to the orderability of cellulose, which for its part is challenged forth by the need for paper, which is then delivered to newspapers and illustrated magazines'. Taken together, I conceive that neoliberalism, and perhaps other forms of *control* technology, may be driven by a desired 'means/end efficiency' of the controller(s). Accordingly, I contend that neoliberalism reveals its essence more so as 'challenging-forth' than as

'bringing-forth', whereby the individual(s) 'controlled' may be perceived along the instrumental lines of 'standing-reserve'[36].

Thus, the multiple faces of technology reveal themselves. It would seem justified to claim that humans, in advanced contemporary society, inhabit a 'technological' world in the sense that technology manifests as multiple different forms: *hard* (inspired by Heidegger's instrumental definition, 1977; Kroes, 1998; and Schoffner *et al*, 2000); *soft* (inspired by Kroes, 1998; and Schoffner *et al*, 2000); and *control* (inspired by Finn, 1960; McDermott, 1981; and Kroes, 1998). Moreover, Heidegger (1977) claims that 'being' is the state wherein humans are supposedly untethered from all preconceived notions of technology that may otherwise skew their perspective of it. In 'being', ancient technology supposedly reveals its essence to humans as 'bringing-forth', and modern technology as 'challenging-forth'. I alternatively envisage challenging-forth as a *proactive bringing-forth*, which is my cue to the apparent consumerist premeditation laden in the mind(s) of those involved in the design, creation and/or implementation of a modern technology in question, and I extend this notion to the political doctrine of neoliberalism. Before examining in detail exactly how neoliberalism is a *control* technology, I now utilize my above *technology concepts framework* to present examples of key *hard* and *soft* technologies that, I argue, were instrumental in paving the way for the birth of a knowledge economy in the context of the university.

[36] Specific examples of the concept of the individual as a mere 'standing reserve' under neoliberal ideology will be explored in more detail in Chapter 4.

3

Hard and soft technologies: birth of a knowledge economy

> The knowledge-based economy can be expected to continue to expand and grow using the ICT revolution as its main medium. (Leydesdorff, 2006: 25)

In this chapter I set out with a clarification of the difference in meaning between the terms 'knowledge' and 'information' because the two are often, wrongly, interchangeably used in the academic literature. Next, I present and explore some concepts from the literature that attempt to capture the notion of a 'knowledge economy', before exploring the characteristics of 'knowledge' as an economic good. Later in the chapter, I change course from the social sciences and philosophy literature to the economics literature in order to present compelling empirical data from two prominent economic papers that reveal a clear correlation between, not just any technology,

but specifically information and communication technologies (ICTs), and the birth of a knowledge economy. The chapter culminates with my use of the *hard* and *soft* technology concepts from my *technology concepts framework* in Chapter 2 in order to argue that certain key *hard* and *soft* ICTs gave birth to a knowledge economy in the current professional context of the university.

David and Foray (2002: 12) state that 'knowledge – in whatever field – empowers its possessors with the [cognitive] capacity for intellectual or manual action'. Information, on the other hand, is a message that consists of formatted data sets or code that remain passive until interpreted by individuals who possess the necessary knowledge to process them (David & Foray, 2002). Furthermore, and along the lines of these definitions, Cowan *et al* (2000) note that the actual nature of the cognitive action by the recipient of the information need not necessarily be solely and uniquely determined by the information itself; instead, it is the 'cognitive context' of the recipient that imparts meaning to the information, which they then enact upon. Finally, the transformation of knowledge into information – important for the digital transmission of knowledge within the context of a knowledge economy – is sometimes called 'codification' (Steinmueller, 2002), a process that allows economists to use knowledge objectively according to the standard tools of economics (Ancori *et al*, 2000).

Turning to the concept of a *knowledge economy*, Smith (2000: 4) notes a pervasive weakness, or total absence, of clarity in the literature on the concept, arguing that the term is more of a 'widely-used metaphor, rather than a clear concept'. For example, the OECD (1996) definition of knowledge-based economies – 'those directly based on the production, distribution and use of knowledge and information' – Smith (2000) argues, serves only to obfuscate a definition because *all* economies are to an extent based on knowledge – from the economy of the Paleolithic era (Smith, 2000), to that of the industrial revolution (Houghton & Sheehan, 2000). Similarly, David and Foray (2002: 9; my emphasis) state that 'knowledge has been at the heart of economic growth and the gradual rise in levels of social well-being since time *immemorial*'. What distinguishes today's knowledge-based economy from those in the past, according to

Steinmueller (2002), is scale and speed, noting fundamental changes to the accumulation and transmission of knowledge.

Not excluding outright any of the above definitions, but instead building upon them, I would like to further add that a knowledge economy in the late 20th century largely refers to the obvious significant (but by no means exclusive) shift[37] from the mechanical production of material goods during the industrial revolution, to the intellectual production, and commodification, of the immaterial good that is knowledge[38]. Powell and Snellman (2004: 201) who also acknowledge a lack of transparency with the term 'knowledge economy' nevertheless define it as the

> production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence. The key component of a knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements in every stage of the production processes, from the R&D lab to the factory floor to the interface with customers.

In breach of the neoclassical model of economics that recognizes capital and labor as the primary factors of production, knowledge in a knowledge economy, according to Burton-Jones (1999), is becoming *the* most important form of global capital, in what he calls 'knowledge capitalism'. This is demonstrable with the political doctrine of neoliberalism, for example, which came to prominence in the western world in the 1980s, and will be subject to my examination in Chapter 4. The political agenda of neoliberalism has been quick to harness the economic return to the state that results from educational investment in the individual – called 'human capital theory' (see Becker, 1964) – against a backdrop of a burgeoning knowledge economy (Olssen & Peters, 2005). In the so-called knowledge economy, knowledge has risen as a robust global commodity that, according to Drucker (1993), is produced by a workforce comprising 'knowledge workers' who use their heads to produce knowledge more so than their hands to produce material objects. Consequently, there has been a shift in the workforce from predominately blue-collar positions to white-collar positions. This example of social reorder within a knowledge economy may be captured by the

[37] Whether this 'shift' was a gradual and discrete transition from one era to the next, or a radical break, is the source of much controversy; see Carlaw *et al*, 2006.

[38] But which, as we will see through the course of the dissertation, is manipulated, stored, transmitted, and generally conveyed by various *hard* and *control* technologies that have an actual physical manifestation.

concept of a 'knowledge society'[39], which reflects the general *social* order of a knowledge economy. It is a concept that

> generally accepts that there are broader social and cultural factors that underlie the techno-economic momentum central to the post-industrial order and acknowledges knowledge's intrinsic value beyond its worth as a commodity. (Carlaw *et al*, 2006: 652; writing about McLennan, 2003)

The actual birth of a knowledge economy – the focus of this chapter – may be attributed to multiple forces. Notably, Dearing (1997) states that information and communication technologies (hereafter 'ICTs')[40], as well as other globalizing forces, most of which are enabled by technology, promoted the production, distribution, and sale of goods – including knowledge – on a global scale. Such globalizing forces, coupled to the rapid proliferation and intensity of new knowledge domains – such as biotechnology, biogenetics, and bioinformatics, all under the umbrella of the 'biological sciences' – in the post-World War II era, were clear causative forces in the birth of a knowledge economy. Indeed, Houghton and Sheehan (2000) cite both 'increasing knowledge intensity' and 'globalization' as the primary dual forces responsible for the formation of, or at least the transitioning of society to, a knowledge economy. Before I build in this chapter my case for technology being a major causative force in the birth of a knowledge economy, it is necessary to first examine how knowledge as an economic good fundamentally differs from conventional economic goods.

Knowledge: an economic good

Stiglitz (1999a, 1999b) states that knowledge in its own right – not necessarily those material media such as books and computers that convey it – is

[39] Philosophical theories, other than 'information age', have been developed to capture the profound social and economic changes to society, now largely agreed among scholars to be 'postindustrial'. For example: 'Disorganized Capitalist' (Lash & Urry, 1987); 'Information Society' (Toffler, 1984); 'Post-Capitalist' (Drucker, 1993); 'Post-Fordist' (Hall, 1996); and 'Network Society' (Castells, 2000).

[40] For the time being, the World Bank (2003a, 2003b) include, under the rubric of ICTs, hardware, software, networks, and media, for collection, storage, processing, transmission, and presentation, of information via the media of voice, data, text, and images. Obvious examples of ICTs include various *hard* technologies (and their cognate *soft* technology) like the television, radio, telephone, and PC.

a 'public' good[41]. Public goods tend to satisfy the economic criteria of 'nonexcludability' and 'nonrivalrousness', in contrast to private goods that tend to satisfy the economic criteria of 'excludability' and 'rivalry'[42]. But as knowledge may be excluded in certain contexts, Stiglitz (1999a) argues that 'impure public good' may be a more fitting label for it. I concur with Stiglitz that knowledge may be excluded in certain contexts, but I take this one step further and argue that knowledge may also be *rivalrous* in certain contexts. I now argue this with the help of two real-life scenarios in the third premise of my four-premise argument that knowledge is a unique economic good:

First, knowledge is 'scarcity-defying' (Stiglitz, 1999a; David & Foray, 2002; Carlaw *et al*, 2006). Knowledge, according to Stiglitz (1999a), does not lose its value like the traditional factors of production that are capital and labor, but actually grows as it is applied. Furthermore, there are zero marginal costs to adding more users (Stiglitz, 1999a) and, according to Houghton and Sheehan (2000), zero marginal costs to manipulate, store, and transmit knowledge. The scarcity-defying characteristic of knowledge may be contrasted with food production, which is subject to scarcity as a result of very high demand, aberrant weather or natural disaster that results in poor crop yield, and/or invasion of the crop by a pesticide-resistant pest, for example. The 'scarcity-defying' characteristic (Stiglitz, 1999a) of knowledge, with the aid of technology like virtual marketplaces and virtual organizations (Olssen & Peters, 2005), has been seized by multiple competing multinational corporations whose primary goal is to innovatively build, expand, and commercialize, the many existing, and often diversifying, pools of knowledge for subsequent sale at profit.

[41] For a historical perspective on 'public goods' see, for example, Desai, 2003. One should not always assume that public goods necessarily increase the owner's utility; Kaul *et al* (2003) introduce the notion of 'public bads' to refer to goods that decrease utility such as, for example, air pollution and financial cognation.

[42] Building on Paul Samuelson's (1954) original mathematical distinction between public and private goods, 'excludability' in economics refers to a good that can only be consumed by an individual who has paid for that good (Gazier & Touffut, 2006; Kaul & Mendoza, 2003). 'Rivalry', meanwhile, occurs when consumption of a good by one individual inhibits simultaneous consumption by others of that very same good (Gazier & Touffut, 2006; Kaul & Mendoza, 2003). I use 'consumption' with caution as it connotes entire exhaustion of the good being consumed, which does occur if the good in question is a nondurable one such as an apple. Knowledge on the other hand does not usually get exhausted as it is consumed (or more appropriately, 'applied'), so I label knowledge a 'durable' good. However, I realize there are instances when knowledge may be a nondurable good when an individual can no longer retrieve knowledge unique to them because of some mental anomaly such as, for example, forgetfulness or dementia. Similarly, knowledge may be nondurable when it is printed in a one-of-a-kind book that subsequently gets lost or destroyed. Knowledge in such scenarios truly is 'consumed' (until the same knowledge is realized/discovered subsequently by another individual) and as such, I believe, it warrants 'nondurable' good categorization in such contexts.

Second, knowledge markets fundamentally differ from conventional commodity markets because knowledge fails to meet the essential market property of homogeneity. The multidisciplinary and multiplying nature of knowledge means that a single given piece of knowledge differs from every other piece – even knowledge within the same discipline. Knowledge markets, then, break with conventional market laws by exhibiting the unique market property of heterogeneity with the implication that knowledge *not* guarded by intellectual property rights (IPRs) has to be transacted in a culture of trust and reputation, otherwise one risks losing their knowledge property upon disclosure of the knowledge[43]. Relatedly, there are extensive externalities associated with knowledge production in the sense that many individuals, beyond the initial creator or discoverer of a given knowledge, benefit economically from its discovery.

Third, I disagree with the general notion among economists that knowledge is a 'public good' (e.g., Correa, 2003; Dalrymple, 2005)[44]. For in practice, depending on a given knowledge and the circumstances, the inherently 'fluid' nature of knowledge defies its very own 'nonrival' and 'nonexcludable' economic labels[45] that economists use to label it a 'public good'. Knowledge is a more fluid good than conventional goods because it is more manipulable than conventional goods in the sense that it has the potential to continually grow and it is continually subject to manipulation and exchange[46]. I propose that knowledge is manipulable and exchangeable by *organic* means in a largely immaterial form by the human mind and speech (each of us carry knowledge in our very own heads, and speak it daily), and by *inorganic* means in a largely material form by the abundance in contemporary society of printed and electronic media like textbooks and the internet, respectively. Such manipulations make knowledge a much more transportable (or 'fluid') good than conventional goods. While it is generally assumed that knowledge is an impure public good by Stiglitz (1999a, 1999b) and economists generally (Stiglitz, 2006), it

[43] Source: 'Analytics of the Knowledge Economy' in the *Knowledge Futures* module from Glasgow University's EdD program (student access only; last accessed 7/29/2012).

[44] This third premise of my argument draws on discussions from my *Open Studies One* module assignment for the EdD program.

[45] Following the definitions given in footnote 42 – not Stiglitz' (1999b) definitions, which differ slightly.

[46] Sure, conventional goods like apples and cars are manipulable in the sense that the former can, for example, be peeled, sweetened and spiced for apple pie, whilst the latter can be spray-painted or retro fitted with a music system. But the point I am making here is that, provided intellectual and/or technological resources are present, there does not appear to be an end point or limit to the degree of manipulation of knowledge – an argument justified by both the unique scarcity-defying, and potentially immaterial, nature of knowledge.

should be appreciated that knowledge in certain highly contextual circumstances may, momentarily, be excludable and/or rivalrous. This point is demonstrable with the following two case studies:

Scenario 1: Knowledge in the example of a non-digitized copyrighted textbook is *excludable* because those who have not paid for the book are prevented from 'consuming' it, which in the above context equates to reading it[47]. Knowledge in the book is additionally *rivalrous* when the physical book[48] is somehow unobtainable such as it being sold-out by all vendors or the book going out of print[49]. This notion of rivalry may be extended to include circumstances wherein these individuals who, despite being able to overcome the book's excludability, are unable to read the knowledge contained in the book (hence 'consume' the good) because of illiteracy or blindness, for example. The physicality of a book and its limited copy number mean all those that have a copy of (and are 'consuming') the book[50] create a barrier to those individuals not in possession of the book (but are willing to purchase it) of simultaneously consuming it[51]. And,

[47] I propose that IPR in the form of copyright protection essentially privatizes the book that in turn confers excludability to the book.

[48] Used here to refer to having a physical manifestation, as in an actual book as we know it in the traditional sense. This contrasts to a digitized book that has no apparent physical manifestation other than perhaps some physical medium, such as a USB flash drive, on which the book is conveyed.

[49] Rivalrous insofar as the owner of the book does not share the knowledge word-for-word with others. But as the casual sharing of knowledge from books *does* inevitably occur among individuals to varying degrees, such as communication from one individual to another of a concept from a book, perhaps 'partial rivalry' is a more fitting label. Therefore, one can *partially* override the rivalry conferred to a book by the book's physicality by, for example, photocopying the book for others (which, incidentally, also overrides the excludability of the book). But such overriding of excludability and rivalry of a good are not limited to knowledge, but can be extended to many private goods. For example, a car is a private good because it being for sale confers to it excludability, whilst only one driver being able to 'consume' the car at any one time confers to it rivalry. But one might argue that the excludability of the car is overridden when the car is given as a gift, while the rivalry of the car is overridden when the car is consumed by the driver along with passengers. Hence, I believe that a good's (non)excludability and (non)rivalry statuses are not set in stone, but instead are open to interpretation and some degree of philosophical malleability.

[50] Here, I expand the notion of economic rivalry to refer to consumption of one good by one individual; or, using my example of a textbook, consumption of a multiply duplicated good (i.e., mass produced, such as a textbook and most other consumer goods) by a collective group of individuals. In the former instance, consumption of the good by the individual prevents simultaneous consumption of the good by other individuals (unless the good is a communal one like the air we breathe, e.g.; see Kaul & Mendoza, 2003). In the latter instance, consumption of the good by either one or more of the individuals within the collective group of individuals that possess the good will not prevent simultaneous consumption of the good within the collective group because each individual possess the good (i.e., nonrivalrous *within* the collective group); but it will prevent simultaneous consumption of the good for those outside the collective group because those individuals do not possess the good (i.e., rivalrous for those *outside* the collective group). Lastly, using my example of a textbook, the point can be made that rivalry is *conferred* by the physicality of the book, whilst rivalry is *mediated* by the collective group of individuals that possess the book.

[51] Unless an interloper peers over the shoulder of an owner reading her book, although this is an implausible argument, as an interloper cannot comprehensively consume the entire book in such a manner. Technically, because the interloper did not purchase the book coupled to their partial overriding the rivalry of the book, the book – to the interloper – reverts to a nonexcludable and nonrivalrous good – that is, a public good. This scenario relates to the 'free rider' problem in economics (see, e.g., Hardin, 2003).

Scenario 2: A single piece of knowledge (not that which is multiply duplicated in many copies of a textbook), such as a patent[52] protecting a pharmaceutical company's blueprint for a blockbuster drug, is *rivalrous*. I conceive that patent protection of the knowledge in this case confers rivalry to the knowledge[53] in a manner similar to the rivalrousness conferred by the physicality and limited copy number of a book. In the case of a patent-protected blueprint for the production of a novel pharmaceutical drug discovered in the university research lab, the patent allows consumption (or use) of the knowledge by only the patent holder(s) of that knowledge that in turn prevents simultaneous consumption by others (the vast majority of the population) of the very same knowledge[54]. It could conceivably be argued that processing fees for patent protection for a given knowledge, fees for licensing the patent, or outright sale of the entire patent, confers *excludability* to the patent that, coupled to the rivalrous nature of the patent, fulfills its potentially 'private good' criteria[55].

Therefore, knowledge may be excludable *and* rivalrous – dual economic labels that designate knowledge a 'private good', which defies the 'public good' designation given to knowledge by many economists.

Fourth, and finally, the transition to a knowledge economy, it has been advocated, requires in the workplace more democratic 'horizontal' pragmatic learning approaches espoused by the likes of Dewey, for example, as opposed to 'vertical' learning structures exemplified by Taylorism (Stiglitz, 1999a, Houghton & Sheehan, 2000). Pragmatic learning approaches are crucial for fostering creative knowledge production and transfer between knowledge workers, as well as facilitating exchange of difficult-to-teach tacit knowledge between them. Stiglitz (1999a) notes that knowledge is produced and transferred more easily at the source – i.e., among

[52] Interestingly, Correa (2003) notes that patent offices in some countries have tended to admit increasingly broad claims in that patents are being granted for items that already exist in nature like genes that have merely been discovered, not invented. He describes patent creation nowadays as 'more of an art than a science under current law' (Correa, 2003: 417).

[53] Rivalry is exemplified further in the closely guarded context of 'trade secrets'.

[54] Except in the case of experimental research exceptions that permit any third party to freely experiment on a patented invention without the prior authorization of the patent holder (this exception applies only to scientific research in the US); see Correa, 2003.

[55] However, it should be highlighted that knowledge that is a private good can be rendered a public good in the context of an individual freely communicating, via speech, writing, photocopying or posting online, for example, the private knowledge to others. Private knowledge is rendered public knowledge – but only to the 'recipients' receiving the free private knowledge because they are neither paying for that knowledge nor are they prevented from consuming it.

knowledge workers – as opposed to originating from vertical hierarchies. This results in more of an 'economics of scope' rather than an 'economics of scale' that defined the Taylorist era (Houghton & Sheehan, 2000).

Thus, knowledge has a number of unique qualities which render it a unique market good that demands unique market properties. Furthermore, the inherently fluid nature of knowledge – enabled by its intangibility, and facilitated by its *organic* and *inorganic* manipulation – allows it to escape the conventional economic labels of *nonexcludability* and *nonrivalry* that designate it, by many economists, as a 'public good'. Knowledge is simply too pervasive and fluid an economic good to be pigeonholed – as my real-life scenarios demonstrate. With this foundation in place, we now turn our attention to the economics literature in order to explore ICTs and their role in the transition of contemporary society to a knowledge economy.

ICTs and a knowledge economy: the empirical connection

An abundance of reports in the academic literature implicates ICTs as a major technological determinant in the transition of society to, and/or driving force of, a knowledge economy[56]. Indeed, Carlaw *et al* (2006: 653) state (albeit in reference to an 'information society') that the

> key element in the transformative properties of the knowledge society is identified as 'information' and here the major factor has been the ICT revolution and in particular the growth of the Internet and more recently digitization.

Moreover, Goschin and Constantin (2007) cite a number of studies that correlate economic growth with ICT production and usage (e.g., Jorgenson & Stiroh, 2000; Oliner & Sichel, 2000; and Chen & Dahlam, 2004). Similarly, the World Bank (2003b) correlates increased human capital accumulation with increased ICT usage. Building on these findings, I will shortly present the argument that key *hard* and *soft* ICTs are instrumental for the enhanced electronic manipulation and sale of knowledge, and hence, helped pave the way for the birth of a knowledge economy.

[56] For example: Dearing, 1997; Antonelli, 1998; Houghton and Sheehan, 2000; David and Foray, 2002; Steinmueller, 2002; OECD, 2004; Lopes *et al*, 2005; Carlaw *et al*, 2006; Fagerberg, 2006; Goschin and Constantin, 2007; and Chowdhury and Alam, 2009.

First, in order to help ground such a notion, I highlight two of the most compelling empirical papers in the economics literature that validate the correlation between ICTs and economic growth[57].

One such study is that by Oliner and Sichel (2000) of the US Federal Reserve. In this study, the authors employ a standard 'neoclassical growth-accounting framework' to examine the economic impact to the US economy from the use (as well as the production) of ICTs. Acknowledging that computer-based networks like the internet and intranets facilitate the vast flow and exchange of knowledge between businesses, their employees, and consumers, Oliner and Sichel (2000) group communication equipment with hardware and software. In doing so, the authors recognize, and their economic data reflects, the economic significance of such technologies – lending further validation to my argument for a role of both *hard* and *soft* technologies in the formation of a knowledge economy. Oliner and Sichel's (2000) study focuses on two main time periods: 1974-90 and 1991-95. The authors present economic data showing, for example, that real nonfarm business output rose at an average pace of about 3% per year during these time periods – with ICT capital contributing a ½ % increase. Oliner and Sichel (2000) derive this result from data showing that computer hardware accounted for a ¼ % point per year of that growth, whilst computer software accounted for about 0.1% point per year during 1974-90, rising to almost ¼ % point per year during 1991-95. Communication equipment, meanwhile, contributed about a 0.1% point per year during both time periods.

The data – relatively consistent with data generated by other economists (Oliner & Sichel, 2000) – clearly implicates ICT usage contributing to the US economy during the time periods studied. The data is modest, but the authors note that this can be explained by the 'productivity paradox'[58] that lasted through the early 1990s, and which refers to the apparent paradoxical slow growth in many sectors of the US economy despite hefty investments by businesses in ICTs (see Brynjolfsson,

[57] The following two papers were published in 2000. For more recent publications implicating ICTs in economic growth see, for example, Tranos (2012) who utilizes statistical tools to determine a relationship between internet infrastructure and European economic development; and Popescu (2012: 59) who cites two recent articles to report that 'ICTs are a major contributor to productivity, profitability, and growth at the level of the firm', and that (unrelatedly) 'in a typical developing country, an increase of 10 mobile phones per 100 people boosts GDP growth by 0.6 percentage points'.

[58] It is widely noted in the economics literature that Nobel laureate in economics, Robert Solow, in reference to the paradox, famously remarked 'You can see the computer age everywhere these days, except in the productivity statistics'.

1993). The most compelling data presented by Oliner and Sichel (2000), reveals resurgence in output growth of the US economy during the latter half of the 1990s (considered to be the end of the productivity paradox) – with overall information technology capital contributing about 1.1% points.

The other prominent empirical study correlating increased economic growth with information technology (IT)[59] usage is that by Jorgenson and Stiroh (2000) of Harvard University and the Federal Reserve, respectively[60]. Here, consistent with the research findings of Oliner and Sichel (2000), the authors note a remarkable transformation in the US economy in the latter half of the 1990s that reflects strong growth in output, labor productivity, as well as total factor productivity. Notwithstanding complex economic formulae and jargon, much of which I do not understand, the crux of Jorgenson and Stiroh's (2000: 60) results reveal a compelling correlation between rising contribution of information technology (IT) and outputs to US economic growth.

Together, these two empirical studies reveal a clear correlation between ICT usage/production and US economic growth[61]. On this note, I now examine key ICTs that, I believe, helped pave the way for a knowledge economy in the context of the university.

Hard and soft ICTs: birth of a knowledge economy

Similar to the disagreement in the academic literature concerning a clear definition for the terms 'knowledge' and 'knowledge economy', Linderhof *et al* (2006) likewise note a 'lack of consensus' in the literature on a definition for ICTs. Nevertheless, drawing on several scholars, Linderhof *et al* (2006: 5) attempt to define ICTs as 'the total of technical equipment, products and services needed to digitize[62], save, process, distribute and communicate information'. Selwyn (2004), more specifically, states that ICT is an umbrella term to refer to a wide range of

[59] IT and ICT are used interchangeably in the dissertation. Selwyn (2004) notes that 'ICT' evolved from 'IT' in order to reflect the rapid convergence of technologies like computers, telecommunication, and broadcasting technologies.

[60] In this study, the authors identify ICT with computers, software, and communication equipment; i.e., various *hard* and *soft* technologies using my *technology concepts framework* in Chapter 2.

[61] For empirical data showing a correlation between European economic growth and ICTs, see, for example, Antonelli, 1998.

[62] Here, I disagree with Linderhof *et al* (2006) that all ICTs digitize information (e.g., the analog television and radio do not digitize information). 'Digital' as a concept will be explored in more depth later.

technologies that include technological applications like computer hardware and software, telecommunication technologies like mobile phones, as well as electronic information resources like the internet. The OECD (2006), meanwhile, defines ICTs for both the manufacturing sector (e.g., office, accounting, and computer machinery; TV transmitters and receivers) and services (wholesale of computer equipment; telecommunications). Regardless of these and other definitions for ICTs, I emphasize that the striking commonalty between all ICTs (and a prerequisite for labeling a given technology an 'ICT') is their *heightened knowledge*[63] *conveyance* quality – compared to knowledge conveyed by the conventional means of a textbook in an era that predates the advent of ICTs[64]. This *heightened knowledge conveyance* is threefold:

1. ICTs generally have a greater capacity to *manipulate knowledge*. By contrast, knowledge in the textbook, from a pre-ICT era, is in the form of 'static' print that cannot be readily manipulated.

2. ICTs generally have a greater capacity to *store knowledge*. By contrast, the pages of the textbook, from a pre-ICT era, limit the very knowledge stored in it[65]. And,

3. ICTs generally have a greater capacity to *disseminate knowledge*. By contrast, the textbook containing the knowledge, from a pre-ICT era, generally has a limited copy number, and the book must be known and actively sought from a bookstore by the buyer; i.e., the owner must *seek* the book – the book does not come to them (unless it is given as a gift or borrowed).

[63] At this point in the discussions, I intentionally use 'knowledge' and 'information' interchangeably. I refer to both terms as 'knowledge' (unless otherwise stated) to be consistent with '*knowledge* economy', even though such a label is inaccurate when one considers that information, as well as knowledge, are conveyed and sold in a knowledge economy.

[64] A good example is the industrial revolution because it is an era marked by considerable mechanical advances in printing whilst still predating ICTs.

[65] Unless one reads the knowledge contained in a textbook, processes that knowledge, and then intellectually builds upon the knowledge by scribbling notes directly onto the pages of the book; in this case the reader is adding to the stored knowledge in the book.

I refrain, for the time being, from explaining *how* ICTs have a heightened capacity to convey knowledge within this framework, instead articulating it in my upcoming argument[66].

Using my *heightened knowledge conveyance framework*, I now set out to argue that the archetypal *hard* ICTs of the television (TV) and the radio, telephone, satellite, and PC, helped pave the way for a knowledge economy in the context of the university[67]. My argument is structured such that each of these *hard* technologies forms an individual premise (four in total, counting the TV and the radio as one) for this central argument. Under each individual *hard* technology premise, I use sub-arguments to show how that *hard* technology has an increased capacity to *store* (first sub-argument), *manipulate* (second sub-argument), and *disseminate* (third sub-argument) knowledge – the three criteria of my *heightened knowledge conveyance framework.* In my argument, I make the distinction that knowledge conveyed by these *hard* technologies may be either: sold within and, hence, *directly* contributes to the economic aspect of a knowledge economy; or not sold within, but somehow *indirectly* benefits a knowledge economy along the way. It is important to keep this distinction in mind as it is used throughout my argument:

First, utilizing my *technology concepts framework* in Chapter 2, and consistent with the general definitions for ICTs above, I argue that the *hard* ICTs of the TV and the radio, which were invented prior to a knowledge economy, nevertheless helped pave the way for it in the context of the university. The TV and the radio satisfy my threefold *heightened knowledge conveyance* prerequisite for ICTs[68] in the following ways:

First, the TV and the radio – or more precisely the controller of these technologies – are more able to *manipulate knowledge* because the controller can instantaneously and limitlessly switch channels from one knowledge-containing program (e.g., news[69]) to another (e.g., a documentary)[70] (see Negroponte, 1996).

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[66] This threefold *heightened knowledge conveyance* quality of ICTs is in part inspired by Linderhof's *et al* (2006) list of distinctions between various different activities related to ICT-mediated digitization.

[67] I do not claim that ICTs were the sole determinant in the creation of a knowledge economy; other technological (e.g., advanced transportation networks) and non-technological forces (e.g., free trade) also helped pave the way for a knowledge economy; see Dearing, 1997.

[68] Compared to knowledge conveyed by a textbook in an era (e.g., the industrial revolution) prior to the advent of ICTs.

[69] Although it should be noted that some might question the neutrality, accuracy, or validity of 'knowledge' broadcast by the mass media; see, for example, Goldberg (2003).

Nowadays, in light of modern recording devices, such as the digital cable receiver box provided by many cable-subscribing companies, the controller of the TV is further able to manipulate knowledge in the sense of pausing, rewinding, fast-forwarding, and recording it in knowledge-containing programs.

Second, the TV and the radio – or more precisely their storage media – have a greater capacity to *store knowledge* in light of archival film stock or videotape that are the physical recording media onto which TV footage is recorded, or videotape that is the physical recording medium onto which radio programs are archived. Nowadays, both technologies probably rely on storing (and recording) programs digitally (see Laurentis, 2006), which means that the hard drive of a computer serves as the storage medium[71].

Third, largely owing to their cognate *soft* technology that is electromagnetic radiation in the form of analog or digital radio waves, or infrared (received or mediated by an antenna, satellite dish, or fiber optical cables), the TV and the radio have a greater capacity to *disseminate knowledge*. Unlike a textbook, which has a limited copy number and the physicality of which can be cumbersome[72], radio waves emitting from one radio tower continuously transmit knowledge over vaster geographic distances (sometimes over several hundred square miles) through solid structures like buildings, thereby disseminating knowledge to the masses.

Within this *heightened knowledge conveyance framework*, how did the TV and the radio as *hard* technologies pave the way for a knowledge economy in the context of the university? The ability of the media to shape public perception is widely documented in the academic literature (see, e.g., Berquist & Golden, 1981; Poster, 1985; and Soderlund, 2007). Poster (1985) refers to film, radio, and TV as the 'first media age' that engages in a one-way 'logic of broadcast' whereby a 'small number of producers sent information to a large number of consumers' (Poster, 1985; cited in Lankshear, 1999: 8). Poster's (1995) 'first media age' contrasts with his 'second media age', which is characterized by a greater reliance on satellite, telephone, TV, and computer-integrated technologies that supposedly break down the

[70] News and documentaries are supposedly knowledge-containing non-fiction programs, but I do not rule out fictional programs as a potential source of knowledge because their content may contain, for example, accurate historical analysis that is, technically, nonfiction.

[71] One might argue that the 'library' is the storage medium for textbooks, and that the storage capabilities of the library exceed those of the TV and the radio. I counter this notion by stressing that the library does not possess the same highly concentrated and compact storage, and editing, capabilities as film and the PC hard drive.

[72] Assuming the textbook does not have a digitized version.

boundaries between producers and consumers of information in a so-called two-way, hence more democratic, 'logic of communication'. Notwithstanding such potential democratizing effects, I nevertheless argue that there is still ample room in the second media age for the media to change public perception. Ladd and Lenz's (2009) study – conducted in the second media age – offers an excellent case in point. Their study contains compelling empirical data that strongly points to the persuasive power of the news media in influencing peoples' political behavior in the run up to the 1997 UK general election. I therefore propose that the continual coverage by the TV and radio media of knowledge about social, political, and economic world affairs in knowledge-containing programs *indirectly* contributed to a knowledge economy by helping to shape viewer/listener perception of society's transition to it. This shaping of perception could conceivably be extended to include, at the time, university personnel by inspiring, and organizationally readying, them for the eventual commercial exploitation of knowledge in the form of *internal research data* that is generated in its research labs.

The TV and the radio, especially nowadays, convey knowledge that *directly* contributes to a knowledge economy by their broadcast of advertisements for knowledge products. Examples of this include the intensive advertising on American TV of pharmaceuticals (Kaphingst *et al*, 2004) by the knowledge-intensive pharmaceutical industry[73], or in the context of 'corporate higher education' (see, e.g., Readings, 1996; Ruch, 2003; Washburn, 2006), the university advertising its degree programs on TV and radio (Kittle, 2000).

Second, utilizing my *technology concepts framework* in Chapter 2, and consistent with the general definitions for ICTs above, I argue that the *hard* ICT of the telephone, which became commonplace in the workplace[74] in the post-World War II era, helped pave the way for a knowledge economy in the context of the university. The telephone satisfies my threefold *heightened knowledge conveyance* prerequisite for ICTs in the following ways:

First, the telephone – or more precisely the controller of this technology – is more able to *manipulate knowledge*. In the case of either a landline or mobile

[73] For the pharmaceutical company as a major knowledge-producing industry, and in turn contributor to a knowledge economy, see, for example, Kofinas, 2008.

[74] Here, I use 'workplace' to generally refer to knowledge-producing institutions, as exemplified by the university and industry.

telephone, knowledge is more manipulable in the sense that it may be conveyed almost instantaneously by making or receiving calls repeatedly to and from one or many 'callers' and 'listeners'. Furthermore, a knowledge recipient may then deliver that knowledge, or a built upon version of it that they have intellectually added to, by telephoning others[75]. Knowledge is even more manipulable in the context of the 'smartphone'. These phones possess PC-like functionality including a keyboard, powerful processors, and full operating system software, which enable users to manipulate knowledge in the sense of, for example, viewing it as a PDF document, and receiving and sending it via email.

Second, the telephone has a greater capacity to *store knowledge*. In the context of the landline telephone that is specifically used to convey university knowledge, it is not the landline telephone per se that has a greater capacity to store university knowledge; rather, it is the telephone switchboard[76]. This claim is justified if we conceive of the telephone switchboard as a 'virtual knowledge storage'. In this conception, the switchboard is a concentrated convergence of potentially thousands of pending university knowledge connections that are wired to the switchboard in the form of telephone cables going to and fro the many offices of university knowledge workers – including the principal investigator of the university research lab – whose telephones are served by the telephone switchboard. The knowledge is 'virtual' because it is not physically present in the switchboard (say, in the form of printed text on paper), but instead immaterially and rapidly flows to and from the switchboard via telephone cables. The telephone operator (or nowadays a computer-controlled relay system) at the helm of the telephone switchboard unlocks the university knowledge of the 'virtual knowledge storage' through the process of connecting callers[77].

[75] But how does this differ from a situation that is devoid of telephones, wherein one individual conveys knowledge from, say, the textbook, to one or many individuals either in person via speech (as in the lecture hall), or by traditional postal service (but not email, assuming we are in a largely pre-email era)? It differs on the basis of the ability of the telephone (as well as the TV and the radio) to convey knowledge on a scale that is far greater – indeed, potentially global – at near-instantaneous speeds. Moreover, these technologies are able to convey knowledge that is entirely new – unlike the knowledge conveyed by a textbook which is static.

[76] If I propose that the 'telephone switchboard' is the larger storage medium for the telephone, I must, in order put the argument on equal playing ground, propose the larger storage medium for the textbook; this, I propose, is the 'university library'.

[77] Building upon my proposals in the previous footnote, surely the 'virtual knowledge storage' concept can be applied to knowledge collectively contained in the textbooks of the university library from a pre-ICT era, thereby negating my argument that the ICT of the telephone switchboard has a greater capacity to store knowledge? I suggest no for two reasons. First, knowledge in a pre-ICT era was not virtual because there were no computers then, which create 'virtuality' (unless we rethink 'virtual' in a broad metaphysical sense that transcends the conventional meaning of technology; see, e.g., Burbules, 2004). Second, compared to the relative scale and vastness of the university library building from a pre-ICT era, the telephone switchboard, in contrast, represents a relatively small – but *highly concentrated* – stock of virtual and potentially *new* knowledge, the sum of which

Third, largely owing to its cognate *soft* technology that is sound waves converted to electrical signals and conveyed by copper wiring[78] in the case of a landline phone, or electromagnetic radiation largely in the microwave range for mobile phones, the telephone has a greater capacity to *disseminate knowledge*[79]. These *soft* technologies defy vast geographic distances at near-instantaneous speeds that disseminate knowledge relatively quickly and cheaply to the masses[80].

Within this *heightened knowledge conveyance framework*, how did the telephone as a *hard* technology pave the way for a knowledge economy in the context of the university? An example of university knowledge conveyed by the telephone that *indirectly* contributes to a knowledge economy is best illustrated if we conceive of the telephone as a '*proactive hard* technology'. In this conception, the telephone requires the *active* participatory efforts of both 'caller', who often has an agenda or purpose upon dialing, and 'listener'[81]. With this in mind, the telephone is a networking tool of revolutionary capacity because it enables university knowledge workers to connect with one another, and with industry, in order to exchange, compare, build upon, and potentially sell to industry, their *internal research data*[82]. But such knowledge is not limited to university *internal research data*; it can include optimized lab protocols that my colleagues and I read in scientific articles, and which I obtain in detail by telephoning the source university research lab[83]. These optimized protocols render my work as a lab researcher – and that of my students, in the context of my role as a lab educator – more efficient, which in turn increases my productivity and that of the university that, in turn, indirectly contributes to the efficiency of a

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could conceivably exceed that contained in the university library. Hence, I believe, that the *hard* technology of the telephone – in light of the telephone switchboard – has a greater capacity to store knowledge than the library from a pre-ICT era.

[78] Here, in the case of the landline telephone, we have a new technology concept that I term 'secondary *hard* technology' (the copper wiring) – connected to the primary *hard* technology (the landline telephone) – that conveys the *soft* technology (i.e., electrical signals originating from soundwaves).

[79] Nowadays, calls made with the landline or mobile telephone may be partially served by the *hard* technology of fiber optic cables and its cognate *soft* technology that is electromagnetic radiation in the infrared range (or the *hard* technology of the satellite; see later).

[80] One might argue, however, that the textbook trumps the telephone in terms of knowledge conveyance because the sheer volume of knowledge contained in the textbook cannot equivalently, and practically, be conveyed by the telephone. However, I counter-argue that the telephone can convey equivalent volumes of knowledge in light of its sister technology that is the facsimile. Also, the telephone and the modern facsimile boast the quality of near-instantaneous knowledge dissemination, including that for new knowledge – a quality that the textbook, which always contains 'static' knowledge, cannot match.

[81] This is in contrast to the TV and the radio that are 'passive *hard* technologies' in the sense that these technologies only allow *passive* one-sided viewing/listening.

[82] In particular, the highly networked and tacit types of knowledge that are characteristic of a knowledge economy – i.e., the 'how to', 'who to', and 'what to' (see Laurentis, 2006: 77) – come to mind.

[83] Why not obtain such protocols by email, which seems quicker and easier? Because the highly tacit knowledge contained in such optimized lab protocols necessitate that the requester speak in person to the lab researcher who wrote the protocol in order to grasp all the critical methodological nuances.

knowledge economy. Muntean and Hauer (2008: 61) lend weight to this notion by stating that the

> dramatic improvements in ICTs [conceivably the telephone] enable knowledge workers [like myself and my students] to rapidly search, collect, evaluate and transmit enormous amounts and varieties of data [including optimized lab protocols] and to engage in complex, collaborative work activities [including the potential sale, or at least negotiation, of *internal research data* to industry] with anyone [outside universities; industry], anyplace, anytime.

Additionally, the telephone and facsimile facilitate novel business propositions – including the sale of lucrative IP – drafted by the university for potential industry buyers.

An example of knowledge conveyed by the telephone that *directly* contributes to a knowledge economy[84] (outside the context of the university) is the newspaper industry, which depends on continual and timely feeds of knowledge that is both entirely novel (a quality that the textbook lacks) and sellable. Nowadays, the advent of mobile telephone technology has rendered the telephone a more cutting-edge journalistic tool for the newspaper industry, and the media in general, in light of its ability to instantly relay news-at-the-scene to the pressroom either verbally (by voice), textually (by text messaging), or photographically (by in-phone cameras)[85]. Another example of knowledge conveyed by the telephone that *directly* contributes to a knowledge economy is the practice of selling stocks over the telephone for trading on stock exchanges, such as the American electronic stock exchange NASDAQ[86].

Third, utilizing my *technology concepts framework* in Chapter 2, and consistent with the general definitions for ICTs above, I argue that the *hard* ICT of the satellite[87] (telecommunication versions of which were active in the 1960s[88]) helped pave the way for a knowledge economy in the context of the university. The satellite

[84] In an era that predates the TV and the radio, and when the newspaper was the primary source of news for the public.

[85] Indeed, such technology has fuelled the democratizing movement of 'citizen journalism' that empowers the public to report, using their mobile telephone, major incidents and news events to the media. See, for example: http://www.nieman.harvard.edu/reportsitem.aspx?id=100542 (last accessed 7/29/2012).

[86] Up until October 1987, that is, when the stock market crashed because many brokers often did not answer their telephones; see 'NASDAQ: Developing the Electronic Stock Market' in a pamphlet entitled *Software and Information: Driving the Global Knowledge Economy*, available at: http://www.siia.net/estore/globecon-08.pdf (last accessed 7/29/2012).

[87] Used here to exclusively refer to 'artificial satellites' that are artificial objects placed into Earth's orbit by humans, in contrast to 'natural satellites' that are celestial bodies that orbit planets or smaller bodies, such as the moon which is the natural satellite of planet Earth.

[88] See: http://history.nasa.gov/satcomhistory.html (last accessed 7/29/2012).

satisfies my threefold *heightened knowledge conveyance* prerequisite for ICTs in the following ways:

First, the satellite – or more precisely the end controller of this technology – is more able to *manipulate knowledge*. Intelsat (2010, online resource[89]), a major US-based communications satellite services provider, defines a communications satellite as a 'radio relay station in orbit above the Earth that receives, amplifies, and redirects analog and digital signals carried on a specific radio frequency'. I refer to those individuals in possession of a *hard* technology that is capable of receiving and processing satellite signals (e.g., a satellite radio) as the '*end* controllers' of the satellite technology[90]. Therefore, it is not so much the satellite per se that is able to manipulate knowledge; rather, it is the end controller of the terminating *hard* technology that the satellite serves, including any of the *hard* technologies I have just explored.

Second, the satellite – or more precisely an onboard computer or the terminating *hard* technology served by the satellite – has a greater capacity to *store knowledge*.

Third, largely owing to its cognate *soft* technology that is electromagnetic radiation in the form of analog or digital radio waves, the satellite has a greater capacity to *disseminate knowledge*. Communication satellites boast a vaster geographic reach than the radio tower because their geostationary nature means that just three satellites strategically placed at the appropriate longitude can broadcast to our *entire* planet (Intelsat, 2010).

Within this *heightened knowledge conveyance framework*, how did the satellite as a *hard* technology help pave the way for a knowledge economy in the context of the university? I propose by acting as a 'radio relay station' for university knowledge (that either *directly* or *indirectly* contributes to a knowledge economy) conveyed by other *hard* technologies. In this sense the satellite, by virtue of global span, facilitates the *heightened knowledge conveyance* function of the archetypal *hard*

[89] Available at: http://www.intelsat.com/resources/satellite-basics/how-it-works.asp (last accessed 7/29/2012).

[90] The fact that the satellite is a radio *relay* station that both receives and redirects radio signals (Intelsat, 2010) renders the satellite with a greater degree of 'technological intermediacy' compared to other *hard* technologies. Such 'technological intermediacy' becomes apparent when one looks at the infrastructure of satellite communications: a *station* on Earth transmits a signal to an orbiting *satellite* that, in turn, transmits the signal to *satellite dishes* back on Earth that, in turn, and finally, transmit signals to receiving *hard technologies*, such as, for example, the TV. Hence, I introduce the coinage '*end* controller' of the technology, as opposed to just 'controller', to reflect the greater degree of technological intermediacy that is characteristic of, and perhaps unique to, communications satellites.

technologies that are central to this argument of mine. For example, the telephone call between the university and a potential international industry buyer of its IP may be part mediated by fiber optic technology within the originating country, and part mediated by satellite technology that bridges the call between the two countries (see Poster, 1995). I conceive that that the satellite may additionally function as a dual 'radio relay station' (as just sketched) *and* 'knowledge acquisition' technology. In this dual function, the satellite acquires from the Earth or beyond our solar system novel knowledge in the form of data that it transmits back to Earth where it is processed, sold within, and hence, *directly* contributes to a knowledge economy. Examples of such knowledge include: meteorological data generated by weather satellites and sold to TV and radio networks, newspapers, and the media in general, for weather forecasting; ecological data generated by observation satellites and sold to research laboratories for strategic planning; global positioning data generated by navigational satellites and sold to transportation industries like ship, airlines, and nowadays even the driving public, for global positioning and real-time navigation; and astronomical data generated by scientific satellites like the Hubble Space telescope and sold to research labs for gaining insights into the origin of the universe. Importantly, the university is a key contributor to the creation of such satellite-generated knowledge and, in turn, a knowledge economy.

For example, Utah State University's Space Dynamics Laboratory was recently commissioned by the meteorological startup firm GeoMetWatch to design an instrument to be hosted on a commercial geostationary communications satellite[91]. Meanwhile, Rutgers University in the US utilize satellite technology to collate meteorological and oceanographic data; their website states that 'you will find all of the available satellite data *products* we offer to research, industry, education, and the general public'[92].

Fourth, and finally, utilizing my *technology concepts framework* in Chapter 2, and consistent with the general definitions for ICTs above, I argue that the *hard* ICT of the personal computer, which increasingly became commonplace in the university (and eventually in the home) in the late 20th century, helped pave the way for a

[91] Read the full news article at: http://geometwatch.com/htm/news/articleID=16973 (last accessed 7/29/2012).

[92] See: http://marine.rutgers.edu/mrs/sat_data/?nothumbs=0 (last accessed 7/29/2012).

knowledge economy in the context of the university. The computer satisfies my threefold *heightened knowledge conveyance* prerequisite for ICTs in the following ways:

First, the computer – or more precisely the controller of this technology – is more able to *manipulate* knowledge in light of the various types of application software specifically designed for computers like the word processor, such as that marketed as 'Microsoft Word' by computer technology corporation Microsoft. Microsoft Word enables greater knowledge manipulation in the sense that knowledge may be subject to various paragraph, spelling, grammar, font, color, cut, copy, paste, and save reformats – multiple times over. The spreadsheet is another example of application software, such as that marketed as 'Microsoft Excel' by Microsoft. Spreadsheets, it may be argued, have even greater knowledge manipulation capabilities over word processors because the former can create knowledge that is entirely new in the form of, for example, statistical trends from raw *internal research data*.

Second, the computer is more able to *store* knowledge. Both the internal central memory of the computer (i.e., the 'hard drive') and its various external memory media have, over time, become increasingly able to store far more knowledge than that contained in a single textbook. For example, the storage capabilities of external computer memory media has grown from the compact cassette tape that is capable of storing 600 KB of data per side to, nowadays, the USB flash drive that that can store in excess of 256 GB of data. Furthermore, the compact, lightweight, and portable qualities of the newer external storage media surpass that of any textbook whose much larger size, heavier weight, and static knowledge, seem cumbersome by comparison. Indeed, Lyotard (1984: 4; my emphasis) states that 'the *miniaturization* and commercialization of machines [including the PC] is already changing the way in which learning is acquired, classified, made available and exploited' (more on this in Chapter 6).

Third, largely owing to the cognate *soft* technology of the telephone, and with computer networks and the internet in mind, the computer has a greater capacity to *disseminate knowledge.*

Within this *heightened knowledge conveyance framework*, how did the PC as a *hard* technology pave the way for a knowledge economy in the context of the university? The PC unequivocally trumps the various other *hard* technologies just

examined in its *heightened knowledge conveyance* because it is fair to say that the PC was originally primarily conceived for knowledge conveyance[93]. From all the *hard* technologies examined so far, the PC is the most revolutionary with respect to a knowledge economy in the context of the university. Three points help validate this claim. Firstly, a key distinction between the PC and the other *hard* technologies examined: the university lab researcher can control what knowledge is *inputted*[94] to the PC (e.g., input of raw *internal research data* into a spreadsheet); how that knowledge is handled therein (e.g., processing the raw *internal research data* in the spreadsheet for conversion to statistical and graphical forms); and *outputted* from the PC (e.g., email of the processed *internal research data* that is part of a larger scientific manuscript to a journal for publication). Therefore, the university lab researcher can often control the knowledge and all aspects of its conveyance from beginning to end[95]. Secondly, the PC nowadays has come to incorporate much of the functionality of the other *hard* technologies just examined, such as the online streaming of TV and radio programs, as well as telephone calls. Therefore, the modern-day PC already is to a degree all these other *hard* technologies combined. Thirdly, is the concept of the 'digital' that is unique to the PC, but which has become incorporated into the various other *hard* technologies just examined in light of their increasing 'computerization'; for example, the increasing conversion of analog radio and TV signals to digital. In light of the concept of the 'digital', the PC is undoubtedly a more powerful knowledge conveyance technology:

> digital communications reduce information into discrete, identifiable and thus, more easily transferable pieces of information. Digital communications also efficiently maximize the transfer of information by allowing more signals to move through a single communication path. (Lipschitz, (1998: e-journal)

Negroponte (1995: 26) puts this statement into profound perspective when he notes, on the concept of the 'digital', that 'a fiber the size of a human hair can deliver every

[93] Not to suggest that the PC was *exclusively* conceived for knowledge conveyance; take gaming and, nowadays, internet shopping and social networking, for example.

[94] The same cannot be said for the other *hard* technologies examined. For example, in the case of the TV and the radio, the controller (i.e., consumer) of these technologies has no control over what knowledge is inputted to them; that control is in the hands of the cable provider in the case of the TV, or the radio station in the case of the radio (and even though the controller can somewhat control what programming is outputted from these technologies by selecting a particular channel, the controller is nevertheless restricted to a set selection offered by the cable provider or radio station).

[95] Aside, that is, from the professional context of a university clerical worker controlled by office superiors who dictate what knowledge the clerical worker inputs to, and outputs from, the PC.

issue ever made of the Wall Street Journal in less than one second (1000 billion bits per second)'. All these qualities empower the PC to convey knowledge that *indirectly* contributes to a knowledge economy through the obvious rapid facilitation and automation of knowledge processing and sorting on my behalf as a lab researcher (e.g., spreadsheets that graphically depict my *raw internal research data*) and lab educator (intuitive animated internet sites that enable my students to grasp challenging scientific concepts).

Knowledge conveyed by the PC that *directly* contributes to a knowledge economy is *internal research data* contained in articles published in peer-reviewed journals that are sold online (at which point the knowledge becomes *external research data*). Such journals are often ultimately owned by multinational publishing conglomerates (see Altbach, 2006) – highlighting their *direct*, and significant, contribution to a knowledge economy.

Thus, the archetypal *hard* ICTs of the TV and the radio, telephone, satellite, and PC, helped pave the way for a knowledge economy generally, and in the current professional context of the university, because of their *heightened knowledge conveyance*. Furthermore, these technologies are technologically complementary to, sometime dependent on, one another, which amplifies their *heightened knowledge conveyance*. Crucially, the cognate *soft* technologies of these *hard* technologies, because of their ability to render knowledge weightless[96], were collectively a key catalyst in the transition of an economy that historically has always partly been based upon the production and sale of knowledge (see David & Foray, 2002; Houghton & Sheehan, 2000; and Smith, 2000) – including that during the industrial revolution – to a literal 'knowledge economy' as we know it today[97].

Moreover, such *soft* technology-mediated weightlessness of knowledge is distinct from the weightlessness of spoken knowledge because the former outperforms

[96] Used here, 'weightless' refers to the apparent immaterialization and, hence, ease of transmission (Negroponte, 1995) of knowledge in transit when disseminated by *soft* technologies. Although one can clearly see with one's own eyes the material telephone cable, for example, that conveys a telephone conversation, one cannot see the actual knowledge being conveyed by it.

[97] Conditions for a literal 'knowledge economy' as we know it today *were* apparently in place during the industrial revolution, such as technological advances in the high-speed printing of knowledge (e.g., newspapers, textbooks), as well as copyright law that essentially protects and privatizes knowledge for its controlled sale on the market (copyright law can be traced to the Statute of Anne, which was formally enacted by the British parliament in 1709 (Drone, 2000) – a period that predates the industrial revolution). But despite such favorable conditions, the *lack* of *soft* technologies, I suggest, was a key inhibitory factor that forestalled formation during the industrial revolution of a literal 'knowledge economy' as we now know it today.

the latter with regard to volume, speed, and geographic distance of knowledge conveyed. Nowadays, all industries including those that seem 'knowledge light' (e.g., the wood industry; see Laurentis, 2006) are seizing ICTs to create and convey scientific knowledge in order to boost company innovation and growth. Such intensive industry-wide utilization of *hard* ICTs and their cognate *soft* technology – in light of the unique inherent scarcity-defying market property of knowledge – has transitioned contemporary society to a knowledge economy.

Now that a knowledge economy has set the *technological* stage, we now turn to Chapter 4 to see how the political doctrine of neoliberalism sets the *economic* stage, for the *technological triumvirate* of university-industry alliances.

4

Neoliberalism as a control technology

> The underlying tenet of neoliberalism is the extension of the market ethic into all areas of social, political and economic life, both as a disciplining mechanism for achieving efficiency in economic activity and as a moral code promoting liberty through private property. (Birch, 2006: 9)

This chapter opens with an excerpt on the contemporary political doctrine of *neoliberalism* – the central topic of the chapter. But an examination of neoliberalism requires, or is at least assisted by, an examination of *classical liberalism* because the latter is considered by many to be the precursor to the former (see, e.g., Peters, 2001a; McCarthy & Prudham, 2004; Olssen *et al*, 2004); indeed, Lipman and Hursh (2007: 162) state that 'understanding neoliberalism … requires a brief review of the history of [classical] liberalism'.

Classical liberalism to the rise of neoliberalism

Gaus (2010, online resource) states that 'liberalism' is not easily definable because it is an umbrella term that encompasses: 1) a political tradition; 2) a political philosophy; and 3) a general philosophical theory. Waldron (1998, online resource) similarly states that

> defining liberalism is, on the whole, a frustrating pastime. There are many ways of mapping this philosophical landscape, and there is no substitute for grappling with the disparate detail of the theories propounded by particular liberal philosophers.

Waldron (1998) echoes the third component of Gaus's (2010) understanding of liberalism, which is a 'general philosophical theory', by stating that liberalism is a heritage of abstract thought about human nature, agency, and freedom, etc. This heritage of abstract thought (some of which we will explore in the chapter), Waldron states (1998), is largely attributable to the early modern English political philosophers Thomas Hobbes and John Locke, the Enlightenment philosophers Jean-Jacques Rousseau, François-Marie Arouet de Voltaire, Henri-Benjamin Constant de Rebecque, and later, Immanuel Kant, and in the 19th century, to Jeremy Bentham, John Stuart Mill and Thomas Green.

According to Peters (2001a), classical liberalism (hereafter 'liberalism') emerged in the 17th century to curtail excessive forms of western state intervention as exemplified by the 'science of the police' (*Polizeiwissenschaft*) that ruled in Germany during feudal times[98]. Harrison and Dye (2010: 42) do not limit the rise of liberalism to just feudalism, but elaborate that liberalism was an 'attack on hereditary pejoratives and distinctions' that extended to the monarchy, the aristocracy, and the state-established church. Liberalism sought to set strict limits to the role of the state in a newly democratized and constitutional conception of governance (Waldron, 1998, online resource; Olssen *et al*, 2004). It is generally believed among scholars that liberalism formed from the two founding ideals of: *individualism*, or 'personal liberty', which includes human equality, as well as freedom of expression, speech,

[98] Olssen *et al* (2004: 79) actually identify three historical phases to classical liberalism: 'political liberalism', which emerged from the 17th century, was a reaction to the excessive authority imposed by the church and the state, culminating in the Puritan Revolution of the 1640s and the Glorious Revolution of 1688; 'economic liberalism', which emerged in the 18th century, sought to institute policies that reflected an emerging capitalist order, particularly with the state's transition to the industrial revolution; and 'social democratic liberalism', which emerged in the 19th century, breaks from the two preceding forms of liberalism in that it sought an interventionist mode of governance to counter the supposed socioeconomic disparities wrought by a fully-fledged capitalist order.

and religious persuasion; and a *limiting government*, which only intervened insofar as to protect the personal liberties of the people[99]. As 'individualism' appears to be the unifying characteristic of liberalism among many, if not almost all, scholars, it warrants a closer analysis.

Waldron (1998, online resource) defines four main elements to individualism, a concept that he intimately ties to human value:

First, and fundamentally, Waldron (1998) states that ultimate value for the individual lies in their personal pains, pleasures, desires, preferences, and ambitions, etc., and that such individualism is what matters the most with regard to social and political outcomes. Waldron (1998, online resource) states that individualism 'excludes social and collective entities from the realm of ultimate goods', and distinguishes 'individualism' from 'egoism' by stating that in the case of the former people still care for one another[100].

Second, Waldron (1998) highlights freedom as a central quality of individualism and that the extent of this freedom, although subject to much controversy, is, according to Waldron, realistically attainable under modest social and political conditions. The extent of such freedom may be measured according to Berlin's (1969) famous dichotomous conception of liberty that has, on the one end, *negative liberty* to refer to liberty free from coercion by others, and on the other end, *positive liberty* to refer to having the necessary resources (often through state provision or intervention) in order to act to reach one's own potential.

Third, is individualism's grounding commitment to equality, although this has been subject to criticism or even outright rejection in contemporary circles, especially by some feminists (see, e.g., Phillips, 2001) who argue that liberalism fails to transcend gender boundaries (Waldron, 1998).

Fourth, and finally, and perhaps most importantly, is individualism's utmost commitment to individual *reason* (Waldron, 1998) – considered at the time, against a

[99] However, there is some variability of opinion among scholars on these two founding ideals; for example, Hudelson (1999) cites 'individual liberty' together with '*free markets*' as the two core characteristics of liberalism.

[100] The basis for such individualization of value varies. For example, Locke believed it to be firmly rooted in a commitment to God, while modern liberalism has taken a largely secular turn as exemplified by the utilitarian movement that rooted the notion of the value of individualism to, for example, desire or preference – personal motives that, accordingly, render value to be individualistic. Recent modern liberalism has appealed to a Kantian approach that links value to the 'lonely individualism of will, conscience and the sense of duty' and which regards humans as lonely individual moral agents who are conceived as an end in themselves – not as a means to wider social ends (Waldron, 1998, online resource). However, Olssen *et al* (2004) note that, contrary to this Kantian viewpoint, the earlier works of Hobbes, Locke, Bentham, Hume, and Mill, paint individuals more in an 'egotistical' and 'self-interested' light, which implies that individuals treat one another as 'means'.

backdrop of an awakening Enlightenment era, to be the ultimate source of legitimacy and authority. The Enlightenment marked an era characterized by a collective disenchantment with religious dogma, superstition, and tradition, and an accompanying revived faith in the application of human-derived epistemology to understand society and human nature (see Harris, 2003); hence, it is easy to see how this era gave legitimacy to, and indeed fuelled, the core individualist quality of liberalism.

Moving forward, and consistent with liberalism's principle of 'sovereignty of the individual', Locke advocated for each and every individual the inalienable right to, and protection by the state of, private property (Kramer, 2004). Private property and liberalism are inextricably tied:

> classical liberals and libertarians have often asserted that in some way liberty and property are really the same and it has been argued, for example, that all rights, including liberty rights, are forms of property; others have maintained that property is itself a form of freedom. A market order based on private property is thus seen as an embodiment of freedom. (Gaus, 2007, online resource)

In sum, under a dual framework of *individualism* – which extends to the right to private property – and a *limiting government*, liberalism represented an apparently civilized mode of governance that was continually cautious of infringing the, then newly granted, sacrosanct civil liberties of the citizenry. Gordon (1991: 15) refers to such a climate of prudent governance as a continual 'critique of state reason'. Here, Gordon refers to Foucault's (1991) conception of liberalism to mean a specific form of state rationality, or 'governmentality' – no doubt driven at the time by the rational mindset of the Enlightenment – which was perpetually policing and critiquing itself in order to avoid slipping into a scenario of 'over-governance' reminiscent of the totalitarian rule of the Polizeiwissenschaft[101]. But paradoxically, under this apparent

[101] Peters (2001a) writes that this 'state rationality' was motivated at the time by an explosive interest in what Foucault (1991) calls the 'art of government', which was motivated by the introduction of economy into political practice (Peters, 2007a). The 'art of government' was preoccupied with the task of determining a rational and legitimate framework for *how* to delicately and democratically govern in a post-Polizeiwissenschaft era that would not yield a hierarchal system like that between the Prince and his principality. Moreover, Olssen *et al* (2004: 74) argue that Foucault's (1991) 'state rationality' as a framework for liberal political execution is not to be represented simply as a 'philosophy' or 'explanation', but rather as a 'complex system of political rationality comprising prescriptions as to how to rule, and how not to rule, of when to rule and when not to rule'. Therefore, in the mind of Foucault, power manifests and works through human beings as subjects; it represents a specific construction of subjectivity that in the current context conceives neoliberalism, not merely as a political philosophy or economic field, but as a specific form of governmentality (see Rose, 1998) that is concerned with *how* power is exercised (Peters, 2001b).

hands-off mode of governance, liberalism, according to Foucault, represented not a mere absence of governance, but rather a specific exercise of rule through which a new form of civil society was to be governed along the lines of a 'state-civil society' relation, and more specifically a 'state-market relation' (Olssen *et al*, 2004: 76). The latter refers to the state fashioning its citizenry, in the interests of state stability and security, along the lines of a, then emerging, capitalist-based economy. Indeed, Peters (2001a: 63) notes that Foucault (1991) argues that the insertion in the 16th century of a political economy (or 'state-market relation' using the terminology of Olssen *et al*, 2004) as a very intentional exercise of 'governmentality' no longer represented a form of government, but rather a designated field of '*intervention*'.

However, aside from legitimate feminist critique (see below), I distance myself from these somewhat skeptical interpretations of liberalism. Indeed, Foucault (1991) paints liberalism in a light that is consistent with my notion of a *control* technology, as delineated in Chapter 2. But bear in mind that when compared to its rather militant predecessor that is feudalism, and in light of its founding democratic values, I stress that liberalism represented a revolutionary political movement because it finally respected the autonomy of the individual, and for the most part, provided sufficient societal order as to avoid those societies under its rule from slipping into a state of outright anarchy.

Consistent with the neoclassical conception of economics, liberalism espouses a free market, or laissez-faire, market model. Indeed, liberalism is, to many, synonymous with 'laissez-faire', and as such it is not uncommon for both terms to appear in the same sentence, or even as a compound term[102]. But this supposed 'free' market tenet of liberalism, as well its founding ideal of individualism, may not be so free for all. For feminists like Lloyd (1995) often feel subjugated by the profound gender inequalities, and their impact on identity and social roles, that are inherently laden in liberalism[103].

[102] For example, in the entry 'Dewey's Political Philosophy' in the *Stanford Encyclopedia of Philosophy*, Festenstein (2005, online resource; my emphasis) writes that 'Dewey was a critic of *laissez-faire liberalism*'. Indeed, an abundance of authors use the compound term 'laissez-faire liberalism'; searching for the term in Google Scholar yielded 2,330 hits (as of 7/29/2012).

[103] Lloyd (1995: 1,319) goes on to state that liberal political theories are seriously flawed because they 'rely on a distinction between public and private life that entrenches sexist and patriarchal practices'. This liberalist dichotomization of life into the 'private' and the 'public' – translated by some feminists into a split between nature/culture, morality/power, or personal/political, for example – seems at odds with the supposed egalitarian ethos of liberalism (Shaver, 1996; Phillips, 2001).

The political doctrine of social democratic liberalism (sometimes called 'new liberalism'; Shaver, 1996) was born around the 1880s out of classical liberalism when the latter began to incrementally incorporate increasing elements of social democratic liberal values and policies into its manifesto. The primary driver for revamping classical liberalism was increasing concern with social stratification (Kotz, 2002) and other related social problems (e.g., legislation to control child labor, education, and increasing healthcare demands; see Lipman & Hursh, 2007) associated with industrialization and a fully fledged capitalist order. The Hungarian intellectual Karl Polanyi (1944; cited in Polanyi-Levitt & Mendell, 1987) stated that the social stratification of capitalism was demonstrable at the time with its dehumanization of the working class, compared to their upper class counterparts in socialist Vienna. This social stratification is dramatically captured by revolutionary political philosopher Karl Marx (and Friedrich Engels) in *The Communist Manifesto* ([1848] 2008). The supposedly more egalitarian nature of state intervention in the context of a social democratic liberal approach to governance, especially in light of its numerous social welfare provisions, sought to diffuse a potential revolutionary 'dictatorship of the proletariat' – the awakening of which was manifest at the time in the growing disgruntlement of organized labor groups (see Goldfield, 1989; Shaver, 1996).

After the Great Depression of the 1930s and the economic strain of World War II (right through until the mid 1970s), social democratic liberalism, or the 'welfare state', became the political orthodoxy as it was fast adopted by the majority of western capitalist nation states (Solo, 1978). A fundamental principle of social democratic liberalism is an increased positive role of the state as exemplified, for example, by extension of the state's social welfare provisions into education and healthcare in the post-World War I period. The 20th century British economist John Maynard Keynes is generally credited as the founding figure of modern macroeconomics[104], commonly called 'Keynesian economics'.

However, rising stagflation in the late 1970s, which was precipitated by the oil crash in 1973 (Cerny, 2008), led to an increased skepticism of Keynesian economics, and the consequent demise in the mid to late 1970s of social democratic liberalism as

[104] *Macroeconomics* is the study of economics at the aggregate level in the sense that it collectively takes into account aspects like GDP, inflation, input, output, and unemployment, in order to evaluate how well the economy as a whole is functioning. Macroeconomics contrasts to *microeconomics*, which refers to the role of constituent components of the economy – individual firms, households, consumers, for example – in determining price and quantity in individual markets (Source: *A Dictionary of Economics*, Oxford University Press, 2009).

the then dominant political paradigm of the time (Hemerijck, 2010). These events resulted in a revived faith among politicians and policy-makers in classical liberalism that led to the rise of a reincarnated version of it called *neoliberalism* (Palley, 2004). I now draw on Peters (2001a; see also Kotz, 2002) who explores the intellectual forces largely responsible for the rise of American neoliberalism before casting this political doctrine in the light of a *control* technology.

Peters (2001a) draws on Gordon (1993) who characterizes three versions of neoliberalism presented by Foucault in his lecture series at the Collège de France in 1979. Namely, post-World War II German neoliberalism (or *Ordoliberalen*) under the government (1974-1982) of Helmut Schmidt, American neoliberalism, and French neoliberalism under the presidency (1974-1981) of Valéry Giscard d'Estaing; the vast geographic span of these three versions of neoliberalism highlights the global grip of this political doctrine from the 1970s onward, which is believed to have originated in Chile in the 1970s (Moore *et al*; 2011). Since the dissertation focuses on the American higher education system and how it is impacted by the dual *technologizing* forces of a *knowledge economy* and *neoliberalism* in America, American neoliberalism is the primary focus here.

The Chicago School and American neoliberalism

The department of economics at the University of Chicago – commonly called the 'Chicago School' – is generally credited with inspiring many of the ideas behind American neoliberalism (Peters, 2001a; Hamann, 2009). Peters (2001a) chronicles the various schools of thought generated at the School since its inception in 1892 by oil magnate John Rockefeller[105]. In its early years between 1920 and 1945, and under the influence of the Austrian and Marshall School economists Frank Knight[106] and Jacob Viner, and later under the influence of the Lausanne school economists Oskar Lange, Henry Schultz, and Paul Douglas, the school may be referred to as the 'First Chicago School'. During this time, and dissociating itself from the then prevailing positivist turn in economic circles, the school strictly adhered to the major tenets of

[105] According to Sally (1997) the Chicago School was founded by political economist Frank Knight.

[106] Students of Knight included the prominent economists Milton Freidman, George Stigler, and James Buchanan (see Sally, 1997).

neoclassical economic theory, despite growing skepticism at the time towards the economic efficiency claims in laissez-faire. The school believed in interventionist approaches to the economy whilst rejecting the then up-and-coming Keynesian revolution (see also Freedman, 2006). Peters (2001a) notes that the 1940s saw the departure of a number of the school's leading economists, including Henry Schultz, which paved the way for a new wave of theorists in the post-World War II period between the years 1945-1960, most notably the agricultural economist Theodore Schultz.

Later in the 1960s the school, which then may be referred to as the 'Second Chicago School', saw the appointment of the Marshall school economists George Stigler and Milton Friedman who continued the school's intellectual commitment to neoclassical economics – the only school of economics at the time to emphatically reject Keynesianism, which had swept most western capitalist states. It is Friedman who advanced the macroeconomic theory of monetarism at the school (see Valdés, 1995), which Friedman, according to Peters (2001a), used to justify rolling back interventionist approaches to the economy. Peters (2001a) states that the Second School underwent a revival of neoclassical economics so much so that it was criticized for being 'imperialist'. These criticisms were levied at the school's ambitious drive to extend the use of economics into traditionally non-economic realms – for example, political science, legal theory, history, and, under the influence of Nobel laureate Gary Becker and his colleague Jacob Mincer, sociology – in order to examine the legal and social norms and rules that underlie their economic activity.

The Third school, which includes the period from the 1970s to the present, bridges Friedman's monetarist theories of the 1960s to a conglomeration of mathematically rigorous schools of thought collectively called The New Institutionalism economics. This economic paradigm

> seeks to explain political, historical, economic and social institutions such as government, law, markets, firms, social conventions, the family, etc. in terms of Neoclassical economic theory. New Institutionalist [economic] schools can be thought of as the outcome of the Chicago's School "economic imperialism" – i.e. using Neoclassical economics to explain areas of human society normally considered outside them. (http://homepage.newschool.edu/het//schools/newinst.htm - last accessed 17/8/2010; cited in Peters, 2001a: 71).

Indeed, Hamann (2009: 41) states that American neoliberals are distinguished by their 'unprecedented expansion of the economic enterprise form to the entire social realm'.

The trend of inserting neoclassical economics into non-economic aspects of life is succinctly captured at the Chicago School by, for example, the pioneering work of Nobel laureate George Stigler and his theories of 'economics of information', as well as the groundbreaking work of Fritz Machlup (1962) and his theories of the 'economics of the production and distribution of knowledge' (Peters, 2001a). Indeed, the latter inspired many of the ideas behind the theories 'postindustrial society', 'service economy', and 'knowledge economy', which have become buzzwords in contemporary academic circles. But probably the most famous synthesis of the theory of economics of information was that developed by Theodore Schultz and former Chicago School graduate student Gary Becker who essentially amalgamated Gregg Lewis's theory on the application of economic theory in labor markets with Schultz's work on human capital. Becker synthesized this work at the Chicago School in his doctoral thesis entitled *The Economic Approach to Human Behavior* (1976).

Human capital theory refers to an individual's total accrued stock of competencies, skills, and knowledge gained through their education, professional and personal life experiences, as well as mobility in the labor market, and which may ultimately be practically applied in the labor market so as to produce economic return (Mincer, 1989; Davidsson & Honig, 2003)[107]. It was only from the 1980s – coincident with the rise of neoliberalism as a dominant political ideology – that Becker's version of human capital theory gained widespread acceptance among politicians and policy-makers. Indeed, Becker (1993) in the Preface to his third edition of *Human Capital* (Becker, 1993) mentions that both former US President George W. Bush and, then current, US President Bill Clinton emphasized the importance of 'investing in human capital' as a means to improve the quality of the workforce – language that, according to Becker (1993), would have been inconceivable in past presidential campaigns (Peters, 2001a).

Crucially, the Chicago School's collective contribution to the economics of information and knowledge, in particular human capital theory, has, according to Peters (2001a), been used as a legitimation by western states for restructuring science and higher education policy (namely the production of research knowledge) along the lines of a consumerist culture in an increasingly privatized welfare regime (Peters,

[107] As the knowledge and skills accrued by the individual are often costly (e.g., tuition fees, cost of textbooks, etc.) they are considered an *investment* for eventual economic return (Mincer, 1989).

2001a; Peters, 2001b; see also Niggle, 2003). The impact on educational reform is profound:

> in the past, so the neoliberal argument goes, too much emphasis has been placed on social and cultural objectives and insufficient emphasis has been placed on economic goals in education systems and the promotion of a greater partnership between education and business. Henceforth, the prescription is for greater investment in education and training as a basis for future economic growth. Such investment in human skills is underwritten by theories of human capital development. (Peters, 2001a: 74)

Neoliberalism as a control technology

American neoliberalism is exemplified by the policies of former US President Ronald Reagan (see Kotz, 2002; McCarthy & Prudham, 2004) of the Republican Party who was in office between 1981 and 1989, and more recently by the policies of former US President George W. Bush (see Cohen, 2007, online resource[108]), also of the Republican Party, who was in office between 2001 and 2009[109]. These neoliberal tendencies of the US Republican Party are consistent with neoliberalism being synonymous with the 'new right' (Olssen *et al*, 2004), or along these lines, Cerny (2008: 1) calling neoliberalism a 'nationally rooted transatlantic conservatism' – descriptors that fit precisely with the politically and socially conservative ethos of the US Republican Party[110]. Moreover, Cerny's (2008) 'transatlantic' descriptor is undoubtedly a reference to the pro-globalization ethos of neoliberalism (see, e.g., Kotz, 2002; Worth, 2002; Hursh, 2004; Olssen *et al*, 2004; Olssen & Peters, 2005; Cerny, 2008, Frake, 2008; and Heron, 2008) that is demonstrable with the following features: the switch from fixed to floating currencies in the international monetary system, concurrent with the collapse of the Bretton Woods system that was synonymous with the Keynesian era (Worth, 2002); the proliferation of multinational corporations whose production or delivery enterprises stretch beyond the company's home country; and significant technological transformations especially in the area of ICTs (Cerny, 2008). Kotz (2010) similarly states that neoliberalism promotes the free

[108] Available at: http://www.washingtonpost.com/wp-dyn/content/article/2007/05/28/AR2007052801053.html (last accessed 7/29/2012).

[109] However, Kotz and McDonough (2008) note that neoliberal restructuring in the US actually began as early as the mid 1970s with Democrat President Jimmy Carter who, the authors state, 'made a sharp turn to the right'.

[110] British neoliberalism is exemplified by the policies of former Prime Minister Margaret Thatcher of the Conservative Party who was in power between 1979-1990; see the dissertation of Jones (2009), the abstract of which is available at: http://repository.upenn.edu/dissertations/AAI3381872/ (last accessed 7/29/2012).

passage of goods, services, capital, and money across national boundaries, meaning that corporations, banks, and individual investors, for example, are free to move their property across state lines as well as to acquire foreign property. At the national level, meanwhile, neoliberalism is concerned with the following: dismantling the relics of the Keynesian welfare state in order to cut back, or eliminate entirely, social welfare programs; deregulation of the private sector with tax reductions on businesses and the investing class; and deregulation and privatization of the public sector that extends to higher education (Kotz, 2010).

The vast majority of the academic literature, for one reason or another, paints neoliberalism in a predominately pejorative light[111]. For example, Giroux (2002) refers to neoliberalism as 'ideological', while others, like Hursh (2000), view it as 'hegemonic' – descriptors that are perhaps rooted in the notion of neoliberalism as a *control* technology[112]. Before embarking on this argument, and in order to avoid it sounding illogical, it should be noted that the notion of neoliberalism as a *control* technology which, at the same time, reflects a classical liberal and laissez-faire freedom sounds somewhat contradictory. This apparent contradiction is picked up by many:

• Rose (1993: 298) famously refers to neoliberalism as a *contradictory* hand-on/hand-off mode of 'govern(ing) without governing'.

[111] See, for example, Peters, 2001a, 2001b; Worth, 2002; Niggle, 2003; Olssen *et al*, 2004; Ong, 2006; Liu, 2007; Cerny, 2008; Heron, 2008; Giroux, 2009; and Read, 2009. However, it should be noted that 'neoliberalism' is not an exclusively pejorative concept; neoliberalism is portrayed in a *positive* light by Nicholls (2008), for example, who conceives Fairtrade as a neoliberal solution to problems with trade, which actually benefits the livelihood of third world farmers. See his article at: http://www.fairtrade.org.uk/includes/documents/cm_docs/2008/a/alex_nichols.pdf (last accessed 7/29/2012). Additional examples of neoliberalism portrayed in a positive light include Shearmur (1992) whose article is a systematic and vehement rebuttal of the criticisms of 'neoliberal ideology' levied by another scholar; and the University of Cambridge Master of Philosophy in Development Studies Blog that has a multi-part article entitled 'In Defense of Neoliberalism' available at: http://cambridgedevelopmentstudies.wordpress.com/2011/04/12/in-defense-of-neoliberalism-part-i/ (last accessed 7/29/2012).

[112] One blatant example, in the context of 'educational reform', is presented by Ball (2003), for example, who is worth quoting at length. Ball (2003: 216) cites three 'policy technologies' comprising the 'market', 'managerialism', and 'performativity', that 'collectively involve the calculated deployment of techniques and artifacts to organize human forces and capabilities into functioning networks of power'. On 'performativity', Ball (2003: 216) goes on to write that it 'is a technology, a culture and a mode of regulation that employs judgments, comparisons and displays as means of incentive, control, attrition and change – based on rewards and sanctions (both material and symbolic). The performances (of individual subjects or organizations) serve as measures of productivity or output, or displays of 'quality', or 'moments' of promotion or inspection. As such they stand for, encapsulate or represent the worth, quality or value of an individual or organization within a field of judgment'. Despite only citing 'neoliberalism' a couple of times in his paper, Ball's (2003) writings are an unambiguous reference to it.

• Davies and Petersen (2005: 93; original emphasis), in the context of higher education, note that neoliberalism 'sets intellectual workers free to produce their critiques *and at the same time and through the same practices* governs them, shapes what they do and what they desire'.

• Cerny (2008: 1; my emphases) says that

> neoliberalism in its varieties… *paradoxically* includes an active role for the state in designing, promoting and guaranteeing the free and efficient operation of the market (Plehwe, Walpen and Neunhöffer, 2006) – a kind of *imposed* laissez faire somewhat analogous to Rousseau's image of people being "*forced to be free*".

• Read (2009: 29; my emphasis) views neoliberalism as a 'trajectory [that] follows a fundamental *paradox*; as power becomes less restrictive, less corporeal, it also becomes more intense, saturating the field of actions, and possible actions'.

Consistent with these authors, I suggest that the inherently contradictory nature of neoliberalism may be reconciled by framing it as a *paradoxical control technology*. With this in mind, I now build my central argument that neoliberalism is a *control* technology[113]. In doing so, I use my *technology concepts framework* in Chapter 2 to examine the following four major (but not exhaustive) neoliberal concepts: *Homo economicus*; *responsibilising the self*; *public choice theory*; and *agency theory*. I explore each of these concepts individually with a footnote at the end of discussions on each providing a specific working example of the concept in my current professional context of the university:

[113] What renders the political doctrine of neoliberalism a *control* technology? For do all political doctrines – good and bad – not 'control' the population to some degree? Indeed they do, when one considers the plethora of *economic* controls, for example, like legal enforcement by the state of the population to pay Federal taxes at a pre-determined rate, or *social* controls, for example, like legal enforcement by most American states of school attendance. But such controls generally provide a necessary and democratic governing infrastructure that is essential for the stable and efficient wellbeing of both the individual and the state. Crucially, the precise nature of 'control' in *control* technology in the current context is intended to imply a level of control that results in, relative to other political doctrines (aside from dictatorial agendas), more or weightier undemocratic consequences for the individual. I say 'relative to other political doctrines' because even the most democratic of political doctrines will always appear somewhat undemocratic to some individuals or groups, especially in the minds of those who feel subordinate to the state, as in the case of many gays in most American states where, under a current 'democratic' government, Federally-recognized marriage is not an option. There is an abundance of academic literature on neoliberalism as an undemocratic political doctrine, especially in the field of education (see, e.g., Timney & Kelly, 2000; Davies & Petersen, 2005; Brown, 2006; and Giroux, 2009). I will in the course of my argument on neoliberalism as a *control* technology, and later in the dissertation, demonstrate *how* and *why* neoliberalism is undemocratic, or how it 'de-democratizes' as some in the academic literature speak of it.

First, and fundamentally, is the fundamental shift in subjectivity of the individual from '*Homo economicus*'[114] in classical liberalism to 'manipulable man' under neoliberalism (Olssen *et al*, 2004: 137). *Homo economicus* is traditionally perceived as an egoistic, rational utility-maximizer (Litfin, 1996), with 'rational' intended to evoke a sense of self economic 'means-end efficiency', and not necessarily 'rational' in the wider social or ethical sense of the word. Read (2009: 28) adopts a Foucauldian perspective to argue that *Homo economicus* undergoes a fundamental anthropological reconfiguration as a *natural* creature of 'exchange' in classical liberalism to an *artificial* creature of 'competition' in neoliberalism – what Olssen *et al* (2004) refer to as 'manipulable man'. The switch in subjectivity under neoliberalism to 'artificial' and 'manipulable' is laden with the language of *control* technology, which recall from Chapter 2, refers to 'mental *control* technologies' of the 'unconsciously-mediated kind'[115]; 'manipulable', in particular, is indicative of the unconscious dimension of *control* technology.

For Read (2009), neoliberalism is a particular construction of 'subjectivity', of the way in which individuals are constituted as subjects of 'human capital'[116] in a contemporary society so permeated by the application of neoclassical economics that society has become 'subsumed' by capital. Indeed, Rose (1999; 141; cited in Davies & Petersen, 2005: 77) states that 'all aspects of social behavior are now [in a neoliberal era] reconceptualized along economic lines'. What is lost under neoliberalism, according to Read (2009: 35), is the rich heterogeneity of spheres and representations of subjectivity, and the critical distances opened up between them, such as the Marxian relationship of 'work' and the 'market', or the classical liberal relationship of 'citizen' and the 'economic subject'. These spheres under

[114] In keeping with the taxonomic rank of biological classification, I have italicized this concept – like *Homo sapiens*, for example – even though it frequently fails to be done so in the academic literature.

[115] 'Unconscious' in the sense that those controlled by neoliberal ideology are largely incognizant of both being controlled by the state and/or the associated undemocratic forces that ensue, otherwise one would expect arousal of a collective (as opposed to 'minor', as in the academic literature) opposition, resistance, or revolt, by these individuals to overturn the *control* technology that is the neoliberal party in power. This latter scenario is distinct from an electorate voting out a neoliberal party in power at the next general election, not because the electorate is cognizant of the neoliberal party in power being a *control* technology, but because the electorate is disgruntled with the party's policies and/or socioeconomic outcomes resulting therefrom. Further to the unconscious dimension of *control* technology, Davies and Petersen's (2005: 84; my emphases) empirical research draws on Fairclough (2000) to note that 'the *naturalizing* and *normalizing* of neo-liberal discourse … becomes '*mundanely familiar*', [and] enables intellectual workers [e.g., university faculty] to slide into the new ways of speaking and writing about what they do, performing themselves appropriately in a global discourse that apparently brooks no dissent'.

[116] This is in contrast to the Marxian notion of 'fixed capital' to include the inanimate objects and tools – factories, machines, etc. – that contribute to the mode of production.

neoliberalism merge into one to create a society permeated by production, and in which the individual is perpetually perceived as 'entrepreneur' (Read, 2009).[117]

Second, is Peters' (2001b) concept of 'responsibilising the self' – his coinage for the greater neoliberal concept of the 'entrepreneurial self' (see, e.g., Brown, 2006). The 'entrepreneurial self' describes the entrepreneurial relationship that one is forced to embrace by bearing the economic and moral burden of the cost of one's own health care, education, and other social welfare needs – through insurance programs, loans, and user charges, for example – in the context of the pervasive neoliberal trend of privatization, commercialization, and contracting-out, of public social welfare provisions (Peters, 2001b). Yates and Lakes (2010) extend the concept of the 'entrepreneurial self' beyond welfare to include the perpetual self training and skilling that highly competitive neoliberal labor markets demand from knowledge workers. Such a scenario, Rose states (1999: 161; cited in Yates & Lakes, 2010), is a 'continuous economic capitalization of the self'. The 'entrepreneurial self', then, is a relationship characterized by the departure of a democratic 'culture of dependency' as the hallmark of the Keynesianism welfare era to one of 'self-reliance' under neoliberalism (Peters, 2001b: 58). Similarly, Giroux (2002: 429), speaking in the context of a neoliberal-driven corporatization of higher education notes that

> the attendant reorientation of culture to the demands of commerce and regulation has substituted the language of personal responsibility and private initiative for the discourses of social responsibility and public service. This can be seen in the enactment of government policies designed to dismantle state protections for the poor.

Similarly, Read (2009) notes that the popular trend of temporary and part-time employment contracts not only frees corporations from the burden of costly full-time contracts and expensive commitments to health care benefits, but it also reinforces the

[117] *Working example of* 'Homo economicus': Davies and Petersen (2005) present applied research in the form of biographical sketches from university faculty who, the authors claim, collectively demonstrate ways in which a form of neoliberal managerialism is not only passively taken up in the discourses and practices of university life, but has created a culture that forestalls resistance to such managerialism. Davies and Petersen's (2005) paper present reports from teachers that detail a controlling neoliberal trend of placing greater value on seeking research dollars outside the university than on publications generated therein. Here, 'each worker becomes the new Darwinian subject, and only the fittest will survive. Competition and hierarchical domination over others, even the destruction of others, are legitimated if they lead to survival. The *terms* through which survival is guaranteed, however, cannot be questioned, since the possibility of non-survival is always present for those who do not adapt. The emphasis on individuality is central. The competitive individual must resourcefully pit themselves against the others' (Davies & Petersen, 2005: 89). Therefore, *Homo economicus* under neoliberalism represents an aggressively competitive character – i.e., 'manipulable man' – more so than *Homo economicus* in classical liberalism.

cultural reconstruction away from 'workers' who gain something through collective camaraderie towards 'companies of one' (i.e., the 'entrepreneurial self').

The 'entrepreneurial self' is undemocratic because 'this master narrative ['the entrepreneurial self'], which projects a national ideological vision, differs from the social democratic narrative: it does not adopt the language of equality of opportunity and does not attempt to redress power imbalances or socioeconomic inequalities' (Peters, 2001b: 66). Peters (2001b: 58, 60) employs language like 'neoliberal restructuring', 'prescription', and 'engineering', in reference to the state's construction of the 'entrepreneurial self', language that speaks of *control* technology. For example, 'engineering', which may be defined as 'the art or science of making practical application of the knowledge of pure sciences…'[118], and may be applied here to the science or 'art of government', suggests a deliberate molding of the individual into an 'entrepreneurial self'. 'Engineering' is additionally defined as 'artful or skillful contrivance' that implies – coupled to 'prescription' which suggests a dispensing of state rule to the population – that individuals are controlled passively so, which is wholly consistent with the unconscious dimension of *control* technology.[119]

Third, is the new public management (NPM)[120] tool of public choice theory (PCT), which I suggest provides the economic architecture for *Homo economicus* and

[118] See the definition of 'engineering' at Dictionary.com: http://dictionary.reference.com/browse/engineering (last accessed 7/29/12).

[119] *Working example of 'responsibilising the self'*: This concept applies to students burdened with the responsibility of paying their own tuition fees with student loans, for example, in an increasingly privatized higher education system under neoliberalism where social welfare provisions have been phased-out, or abolished altogether. Indeed, Tilak (2006: 3), writing about the global trend in declining public expenditure for higher education, states that higher education is no longer a public good, but rather a 'highly individualized private good'. Similarly, US interest group The National Center for Public Policy and Higher Education cite not only escalating tuition fees, but the additional burden of new fees and reductions to student assistance (Source: http://www.highereducation.org/reports/affordability_supplement/affordability_1.shtml – last accessed 7/29/2012).

[120] NPM refers to the extensive market-oriented and deregulatory overhauls of the public sector that were instituted by neoliberal governments in the 1970s and 1980s. Tolofari (2005: 75) notes that 'NPM is characterized by marketization, privatization, managerialism, performance measurement and accountability [of the public sector]'; Olssen and Peters (2005: 322) similarly note that NPM is characterized by 'deregulation', 'corporatization', and 'privatization' [of the public sector], with the state's end goal of modeling the public sector on the private sector. Accordingly, the focus is shifted from the 'social contract' to the 'economic contract' (Zanetti & Adams, 2000: 534). Tolofari (2005) lists 'public choice theory', 'transaction cost economics', 'agency theory', 'micro-economic theory', and 'the new economic sociology' as its principal economic restructuring strategies. NPM is a popular product, or strategy, of neoliberal governance, and as neoliberalism is painted by many scholars in a pejorative light, NPM naturally is too. For example, Timney and Kelly (2000: 557) highlight the threat to popular sovereignty that they believe is inherent in NPM by stating that 'the commodification of government services by the private sector leads to a replacement of public values of openness, accountability, and transparency – 'publicness' – by private values of profit maximization and consumerism. Most dangerous is the decline of democratic deliberation within the administration of public programs'. Meanwhile, Balfour and Grubbs (2000: 570) draw a striking parallel between the detachment of employees under the corporate reengineering of the

responsibilising the self[121]. Central to PCT is the neoclassical notion of the individual as a rational, self-interested utility maximizer (*Homo economicus*) who is preoccupied with fulfilling and advancing their own goals, and from which behavioral assumptions are derived for deductive models of politics and government (Nesslein, 2008). In other words, in the context of *Homo economicus*, PCT extends the application of neoclassical economic theories and methods to political behavior, which is an area normally confined to the province of political science (Shughart, 2011, online resource[122]). Crucially, according to Olssen and Peters (2005), and Brendel (2009), state insertion of PCT into the public sector marks a major switch from classical liberalism to neoliberalism with the respective switch from a *negative* to *positive* exercise of political power. Accordingly, the unfettered social and market spontaneity of classical liberalism, believed by Friedrich Hayek to be the best allocator of resources because of its supposed natural tendency towards equilibrium, as reflected in the self-ordering tendency of population dynamics, crystals, and galaxies, becomes substituted in neoliberalism with what Burchell (1996: 23; cited in Peters, 2001a: 62) calls '*artificially arranged* or *contrived* forms of the free, entrepreneurial, and competitive conduct of economic-rational individuals'.

The pro-monetarist economist, James Buchanan, is an open critic of Hayek's evolutionary market philosophy. On his call for overhaul of the market with PCT, Buchanan makes the distinction between the 'protective state', which refers to the necessary legal and defense framework, and the 'productive state', which refers to the political framework that may be conceived as both 'policeman' and 'watchman'. Crucially, according to Olssen and Peters (2005), in the context of PCT, Buchanan's distinctions are essentially distinctions between the 'negative' and 'positive' roles of the state, respectively. Hence, the positive arm of the 'productive state' provides the necessary reason for *action* within the rules and laws selected by the negative arm of the 'protective state':

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private sector – as portrayed in Richard Sennett's *The Corrosion of Character* (1998) – and the 'unintended, deleterious consequences for the public employee' that has ensued from the 'excessively rule-bound', 'hierarchic', and 'inflexible' nature of NPM-reengineering of the public sector.

[121] PCT theory emerged around the 1950s, but it was not until the mid 1980s that it gained widespread attention largely due to James Buchanan, one of its two founding figures, who won the Nobel Prize in economics for his contributions to the field (see Schneider & Damanpour, 2002).

[122] Available at: http://www.econlib.org/library/Enc/PublicChoice.html (last accessed 7/29/2012).

> Buchanan's state has a positive arm. Hence, while the stringent constitutional safeguards on the protective state make any change in the status quo or redistribution of property almost impossible, the positive arm of the productive state effectively extracts compliance from individuals in order to engineer a market order. In doing so it cuts across the traditional guarantees of classical liberalism regarding the spaces it sought to protect – a domain of personal freedom, the rights of privacy involving freedom from scrutiny and surveillance [e.g., Peters (2001b) mentions new biometric approaches to thwart benefit fraud], as well as professional autonomy and discretion in one's work [e.g., Ball (2003) cites erosion of these by the controlling neoliberal practice of 'performativity']. (Olssen *et al*, 2004: 159).

With this is mind, PCT is consistent with the definition of '*control* technology' because of the state's use of its positive arm, which displays clear elements of undemocratic and unconscious control. PCT is fundamentally undemocratic because at its heart social behavior is pervasively 'reconceptualized along economic lines' (Rose, 1999: 141); it drives '*Homo economicus*' and 'responsibilising the self'.[123]

Fourth, and finally, is the NPM tool of agency theory (AT)[124]. AT, sometimes called the 'principal-agent problem', occurs in knowledge-producing professions, including the current professional context of the university research lab, under conditions of 'asymmetric knowledge' between an 'agent' and a 'principal'. AT describes the common workplace scenario of the attempts of a principal to motivate an agent in order to extract from the agent knowledge or information that is profitable to the principal, but relinquishment of which by the agent is often costly to the agent (Kivistö, 2005). In the context of *Homo economicus*, the self-maximizing and rational goals of an agent are brought into alignment with those of the principal, by the principal, under conditions of greatest efficiency in terms of profit maximization (intellectual and/or monetary) for the principal, and compliance of the agent to their contractual obligations. AT is often mutually underwritten by a contract that

[123] *Working example of 'PCT'*: PCT is exemplified by the university practice of patenting public knowledge – in the form of *internal research data* – generated in its research labs. Patenting such knowledge essentially privatizes it, which in turn sequesters the knowledge from the historically-perceived 'public' sphere of the university – and society at large. Indeed, Orr (1997: 56) states that 'commodified knowledge [originating from the university] is not available for social use', highlighting 'IPRs' as a specific mediator of this trend. This seemingly undemocratic scenario is particularly prevalent in a neoliberal era wherein the 'funding of universities has come to depend less on state support, and more on the … commodification [via patenting] of university research' (Denning, 2005: 9).

[124] AT is the 'subject' of (Olssen & Peters, 2005), and therefore is inextricably tied to, the NPM strategy of 'transaction cost economics' (TCE). Extending Tolofari's (2005) definition, transaction costs are basically those auxiliary costs incurred before, during, and/or after, an economic transaction and which reside outside the bare cost of the good in question. Perrow (1986: 18; cited in Olssen & Peters, 2005: 320) state's that TCE is 'relentlessly and explicitly an efficiency argument'. Similarly, Tolofari (2005: 81) states that 'central to the theory [of TCE] is that alternative methods, and attendant costs, for carrying out projects or delivery of services are examined for their merits, usually judged by the cost (Boston *et al*, 1996; Ferlie *et al*, 1996). The question of efficiency is still the crux here'. Hence, the formula for TCE sounds like 'minimizing the various inputs of a given system whilst maximizing the various outputs'.

stipulates some form of remuneration (salary, commission, compensation, incentives, etc.) payable to the agent upon implicit provision to the principal of the good – for example, repeated release of lucrative knowledge/information over time – ideally at a price lower than if the principal were to personally provide the good (Tolofari, 2005).

AT was originally conceived as an efficiency tool for businesses in the private sector, but in a neoliberal era of NPM it has increasingly been applied to the public sector as a means of maintaining efficiency and tracking accountability of employees because the public sector lacks the same market discipline that characterizes the private sector (Gordon, 1995; Olssen & Peters, 2005). Gordon (1995), reporting on the neoliberal application of AT to the New Zealand schooling system, cites specific policy examples as the 'coercive' means through which the agency problem in the context that she describes is resolved. Olssen and Peters (1995: 324) draw on other findings on AT that report 'increased tensions', 'rivalry', and 'disruptive sub-cultures', of this neoliberal market reform strategy. Moreover, both Gordon (1995), and Olssen and Peters (2005), state that AT lines of command are '*hierarchal*'. Such descriptors reinforce the inherently manipulative, and therefore undemocratic, nature of AT, and justify categorization of AT, under the broader banner of neoliberalism, as a *control* technology. Moreover, the *implicitness* of compliance of the agent to the principal's commands within the dynamic of AT is indicative of unconscious behavior that is consistent with the unconscious dimension of '*control* technology'.[125]

Thus, neoliberalism is a *control* technology because *Homo economicus*, *responsibilising the self*, *PCT*, and *agency theory* – all concepts unique to neoliberalism – fit with my notion of *control* technology, as delineated in my *technology concepts framework* in Chapter 2 (and earlier in this chapter). Crucially, the common threads that tie these neoliberal concepts together, and a prerequisite for neoliberalism being a *control* technology, are their dual *unconscious* and

[125] *Working example of 'AT'*: In the university research lab, a hierarchal situation often occurs whereby a postdoctoral fellow (i.e., the 'principal') pays the salary, via research grants, of a research technician (i.e., the 'agent') for the purchase of the good that is *internal research data* that the agent is contractually obligated to generate (the moment in time at which the agent generates the data and thereby possesses the knowledge – but not the principle – is the moment of 'asymmetric information'). The principle often incentivizes the work of the agent in order to extract the good (that being data) in the form of a promise of publication of the agent's work in a peer-reviewed journal. However, consistent with the model of AT, relinquishment of the good by the agent often costs the agent the much coveted first authorship ranking on the publication because it is instead taken by the principle.

undemocratic dimensions that are heightened relative to classical liberalism[126]. I conceive that the heightened undemocratic dimension to neoliberalism stems from the fact that the individual under neoliberalism is, to borrow Heidegger's concept (1977), instrumentally reduced to a mere *standing reserve* – an endless source of raw material on call and at the predetermined mercy of humans who, in the current context, are *neoliberal politicians* and *policymakers*[127].

The exact nature of *control* in *control* technology in the current context is to achieve the desired state goal of optimal market efficiency, which is accomplished in part by the four featured neoliberal concepts. Optimal market efficiency, as we will see in chapter 5, could not be more relevant in light of the, nowadays, fiercely competitive and highly globalized capitalist economy in which prominent state position is of paramount economic importance. The four featured neoliberal concepts appear to work in *synergy* to help achieve the goal of optimal market efficiency: *Homo economicus* sets the economic tone of the individual as a competitive entrepreneur in a highly capitalized society; furnished with such market mentality, and in a neoliberal era stripped of social welfare provisions, the individual is economically and morally burdened with their own social welfare needs, which creates a scenario of *responsibilising the self*; the state's positive expression of power manifests in the NPM tool of *PCT* that essentially seeks to overhaul the *public* sector by making it an extension of the *private* sector; and *AT* is a hierarchal workplace strategy used by managers, including those in the university, to extract compliance from knowledge workers, akin to the 'carrot and stick' idiom. Crucially, at the core

[126] One might argue that classical liberalism *is* a *control* technology because it *is* undemocratic because of its embodiment of capitalism, which is notorious for creating stark social stratification, as famously captured by Marx ([1848] 2008). But I counter this notion by noting that classical liberalism was founded from *democratic* values that were a response to the very undemocratic nature of the totalitarian state rule that historically preceded it. Furthermore, Kotz (2002) states that the establishment of American capitalism between the years 1800 and 1860 – coincident with the classical liberal era – was kept in check because the 'government played a relatively interventionist role' (Kotz, 2002: 68).

[127] That the individual under neoliberalism is reduced to a mere *standing reserve*, and is consequently treated undemocratically, is demonstrable with the four neoliberal concepts just examined. *Homo economicus*: The individual's 'human capital' (Read, 2009) provides a source of raw material that is indirectly extracted by the state and which, in the context of a knowledge economy, helps to lucratively propel the state's position in the competitive global capitalist economy (Peters, 2001a). *Responsibilising the self*: The individual is implicitly engineered by the state to financially fend *for* their self (and *from* their self, with their own financing) with regard to social welfare provisions. In this model, the individual is controlled by neoliberal ideology to be a *self standing reserve* – a scenario that conveniently exempts the state from providing to its citizens any form of a social welfare system. *PCT*: PCT *is* the specific market architecture – for example, incremental privatization of the public sector, contracting-out of public provisions, creation of quasi markets, etc. (Peters, 2001b) – that is fabricated by the neoliberal state for the efficient *standing reserve* function of the two preceding neoliberal concepts of *Homo economicus* and *responsibilising the self* . *AT*: The 'agent' in the AT model is treated by the 'principle' (but both ultimately by the state) as a *standing reserve* of raw material in the form of lucrative knowledge that is used to maintain maximum efficiency in the knowledge workplace and, in turn, for the state.

of these neoliberal concepts is capitalism. These concepts (and neoliberalism generally) are the cogs that drive the capitalist machinery in the sense that the neoliberal subjection of virtually all public entities to capital – 'the deeply problematic *commodification of everything*' (McCarthy & Prudham, 2004: 276; my emphasis) – increases market efficiency because all entities are forced to compete with one another in a classic case of 'survival of the fittest'[128]. Indeed, the large number of biological evolutionary theory references to free market economics is no coincidence[129]. As I showed, it is the pervasive and profound marketization of the public sector, including higher education, and ensuing undemocratic side effects, that render neoliberalism a *control* technology relative to classical liberalism. It appears that the ethos of neoliberalism is so detached from classical liberalism that it becomes not merely a revival (e.g., Cerny, 2008), but rather a *reincarnation* (e.g., Hackworth & Moriah, 2006)[130], of classical liberalism. In this sense, and consistent with the views of the earlier noted scholars, neoliberalism is a *paradox* because it completely inverts – largely through unconscious and undemocratic means – the free classical liberal ideals it supposedly espouses.

I demonstrated (in the footnotes at the end of each premise to my argument) that the university is not immune to the controlling effects of neoliberalism. Neither is it immune to the forces of globalization, rapid technological evolution, changing knowledge functions, and other forces that are characteristic of postmodernity. These forces have collectively and fundamentally reconfigured the philosophical, political, and economical dimensions of the university. It is this reconfiguration – *the changing face of the university* – that we explore in Chapter 6. Before closing this chapter and moving onto Chapter 5, I want to first discuss the nowadays fashionable political doctrine of the *third way*, and how it relates to neoliberalism.

[128] This is so because a privatized (as opposed to a publicly-funded) university, for example, must compete with likeminded organizations, not just for a prominent market position, but more fundamentally, to economically survive. Without using economic jargon, this is the very basis of competition in a free market. Free market entities, like the privatized university, receive little or no state funding, so they must compete head-to-head with other likeminded entities for private funding from industry or personal benefactors.

[129] For example, Hayek drew from Lamarckian evolutionary theory to describe the natural flow of the free market (Meyer, 2006).

[130] I am highly cautious of stating that neoliberalism is a *revival* of classical liberalism, because to do so is to conflate their political, philosophical, and moral dimensions, which, in turn, is tantamount to claiming that they are the *same* political doctrine. My use of 'reincarnation' reflects the embodiment by neoliberalism of classical liberalism – but in the *variant* form of a *control* technology.

Neoliberalism in disguise?[131]

Despite the demise of Keynesian economics in the 1970s, the ensuing global financial crisis has seen a resurgence in Keynesian policy implementation by, for example, current US President Barack Obama whose political policies lean towards the third way (see Kumo, 2009[132]). The third way is a current, progressive centrist[133] philosophy of governance that is exemplified by the political policies of Democrat President Barack Obama, who was elected to presidency in 2008, and former US Democrat President Bill Clinton, who was in office between 1993 and 2001. In the UK, the Democratic Leadership Council defines the third way as

> a global movement dedicated to modernizing progressive politics for the information age. The third way politics seek a new balance of economic dynamism and social security, a new social compact based on individual rights and responsibilities, and a new model for governing that equips citizens and communities to solve their own problems. (http://www.ndol.org – last accessed 12/26/2008)

Along these lines, I contend that the third way is a *neoliberal-like agenda for a postmodern era*. I say 'postmodern' because, according to the above definition, the third way embraces globalization, the information age, and multiculturalism – key characteristics of postmodernity (see, e.g., Taylor, online resource[134]). I say 'neoliberal' because, according to the above definition, citizens and communities, in true neoliberal entrepreneurial fashion, are left by the state to 'solve their own problems' – a key characteristic of neoliberalism (see previous section). Moreover, and wholly consistent with the characteristics of neoliberal ideology, third way authority Anthony Giddens states that the 'new mixed economy [of the third way] looks… for a synergy between public and private sectors' (1998: 100) and that 'government policy can direct support for *entrepreneurship*' (1998: 124; my emphasis).

Some scholars go one step further than my suggestion that the third way has a 'neoliberal-like agenda'. Some believe that the third way *is* neoliberalism, albeit a

[131] This section of the chapter contains material adapted from my *Educational Policy* module assignment for the EdD program.

[132] Online resource available at: http://www.politicalarticles.net/blog/2009/03/01/the-global-economic-crisis-and-the-resurgence-of-keynesian-economics/ (last accessed 7/29/2012).

[133] But, according to Coulter (1999), the third way has been adopted by parties of the left, center, and even the right.

[134] Available at: http://www.aiias.edu/ict/vol_30/30cc_397-407.htm (last accessed 7/29/2012).

softer[135], rebranded version of it; see, for example, Gray, 1998; Callinicos, 2001; Kelsey, 2002; and Coulter, 2009. Indeed, Coulter (2009: 191; my emphasis) states that the

> Third Way approaches privilege capitalist interests, ensure corporate power, do little to curtail growing income inequality and, in many cases, accelerate it. In practice, *the Third Way is simply a variant of neoliberalism*.

With this in mind, it is conceivable that the third way's collectivist agenda is merely a rallying by the third way politicians of the *entire* citizenry – some minority groups of which are marginalized under the socially conservative ethos of American neoliberalism (see Monini, 2003) – for their collective partaking in a lucrative knowledge economy. Indeed, Giddens warns that a 'highly *unequal* society is harming itself by not making the best use of the talents and capacities of its citizens' (1998: 42; my emphasis). Along these lines, it is conceivable that the third way provision of a reformed social security system is intended by the third way politicians and policymakers to keep sharp the physical, and particularly the mental, aptitude of the *entire* citizenry. Because doing so – according to human capital theory – theoretically translates into greater economic return to the state when these citizens apply their knowledge and skills in knowledge-producing professions in the context of a knowledge economy.[136]

[135] Some would say 'harder'; see, for example, Murphy (1999) whose classification system views the policies of former US President Bill Clinton as a 'hard' third way, while those of the Carnegie Commission Report and the World Drug Report are considered by Murphy as a 'softer' third way.

[136] At the time of writing (Fall 2012), the ongoing global financial crisis not only highlights the delicate interconnectedness of the world's economies, especially in light of the *global capitalist economy*, but it also brings into question the ability of the free market – on which it seems most of the world's industrialized economies are built – to correct itself during such turbulent economic times. We may, therefore, witness in the future a favoring by politicians and the electorate of more interventionist approaches to governance such as the third way.

5

Hard, soft, control: the 'technological triumvirate' of university-industry alliances

> In a global neoliberal environment, the role of higher education for the economy is seen by governments as having greater importance to the extent that higher education has become the new star ship in the policy fleet for governments around the world. Universities are seen as a key driver in the knowledge economy and as a consequence higher education institutions have been encouraged to develop links with industry and business in a series of new venture partnerships. (Olssen & Peters, 2005: 313)

The arguments have been made that a *knowledge economy* was born from key *hard* and *soft* technologies, and that the political doctrine of *neoliberalism* is a *control* technology. It is now time, in this chapter,

to show how these two key historical events – one technological, the other political[137] – prompted the university to begin selling its *internal research data* to industry. In order to do so, we first turn our attention to the Bayh-Dole Act[138] that was passed by the US Congress in 1980. The Act represents a pivotal neoliberal policy move that forged university-industry alliances because it enabled the university, for the first time, to sell to industry its *internal research data* generated from research funded by federal dollars (Boettiger & Bennett, 2006).

The Bayh-Dole Act: forging university-industry alliances

The notion of a *technological triumvirate* can be gleaned from a paper entitled 'Science and neoliberal globalization: a political sociological approach' by Moore *et al* (2011). The authors (2011: 510; my emphasis) specifically correlate the growth of a 'knowledge economy' (representing my *hard* and *soft* technology concepts) with '*new patterns of university-industry relations'* as one way to understand the complex changes associated with 'neoliberal' (representing my *control* technology concept) globalization and science. The authors go on to state that in light of the decline of Fordist production processes in industrialized countries in the post-World War II period, the state became increasingly preoccupied with the creation and utilization of science-intensive knowledge industries like 'information technology', 'nanotechnology', and 'biotechnology' (see also Nelson, 2001), as an alternative means to propel the global economic position of the state in an increasingly competitive and globalizing economy (see OECD, 1996; St. George, 2006; Vallas & Kleinman, 2008)[139]. Moore *et al* (2011) write that concerns with the industrial competitiveness of the US in the post-World War II period were facilitated by growing pressure on American industries to innovate, and these concerns were subsequently amplified by the central neoliberal policy of 'trade liberalization'. Crucially, the university was seen as a pivotal player in industrial innovation because

[137] However, *both* a knowledge economy and neoliberalism are 'technological' in the context of the current *technology concepts framework*. Here, a knowledge economy is 'technological' in the laypersons sense of the term.

[138] The Act is named after the then sponsoring US senators Birch Bayh of the American state of Indiana, and Bob Dole of the state of Kansas.

[139] Industry's (or more specifically biotechnology's) sizable contribution to the US economy is highlighted at: http://www.bio.org/speeches/pubs/ernstyoung.pdf (last accessed 7/29/2012); for a historical analysis of the rise in the post-World War II period of the pharmaceutical industry, in the context of a transnational corporation, see Tyfield (2008).

it is a major producer of such science-intensive knowledge (Sampat, 2006; Thornton, 2009). Consequently, the university saw sharp increases in its funding from industry to advance university research and development (R&D) (Moore *et al*, 2011). Indeed, Moore *et al* (2011) cite striking data showing comparable amounts of expenditure by both the 'state' and 'industry' on academic R&D between the period 1950 to 1980. However, from 1980 onwards, their data shows that industry expenditure on university R&D doubled, whilst state expenditure remained constant – a trend consistent with the data presented by Tyfield (2008). This doubling of expenditure on university R&D by industry is coincident with

> new intellectual property regimes [that] facilitated the repositioning of universities as engines of the new knowledge economy. In the United States, the passage of the Bayh-Dole Act of 1980 (which facilitated university ownership of intellectual property) and the Supreme Court decision of Diamond v. Chakrabarty (also in 1980, which enabled the patenting of life) correspond temporally with the Reagan revolution and the emergence of the roll-back phase of neoliberalism. (Moore *et al*, 2011: 511)

Therefore, in a new collective culture of an increased emphasis on industry funding for university research (Bercovitz & Feldmann, 2006; Moore *et al*, 2011), the imperative of industrial competitiveness, as well as revenue opportunities from the practice of technology transfer (see later), these new intellectual property regimes saw the university begin to 'systematize relationships with industry' via the entrepreneurial establishment of technology transfer offices (Moore *et al*, 2011: 511). The popular IP regime that is the Bayh-Dole Act[140], which paved the way for the prolific practice of university patenting at the end of the 20th century[141], is well chronicled in a paper by Sampat (2006), which we now turn to.

[140] Aside from the Bayh-Dole Act, Birch (2006: 8) tabulates a number of other policy moves (or 'competitiveness policy initiatives') – alluded to in this chapter's opening citation from by Olssen and Peters (2005: 313) – that reinforced the commercialization of publicly funded research. Moreover, these policies were mostly implemented during the neoliberal administration of former US Republican President Ronald Reagan. They include: the Small Business Innovation Development Act of 1982; the National Cooperative Research Act of 1984; the Federal Technology Transfer Act of 1986; and the Biotechnology Process Patent Act of 1995.

[141] I say 'prolific practice' in specific reference to a modern day trend; see, for example, Downing (2005) who traces university copyright law back to the 18th century when copyright served to distinguish and protect authorial *ideas* from authorial *expressions*. Whereas copyright essentially assigned ownership to the professor's *expressions* as manifested in a given written work, *ideas*, on the other hand, were free to circulate in the common expanding knowledge base of the university. What distinguishes the university as a non-profit organization from industry is the fact the former was granted a 'law of exception' that barred the university from claiming ownership of a professor's copyright.

In light of the massive increase in federal R&D funds awarded to the industrial sector in the post-World War II period, Sampat (2006) states that there was a contentious debate over who should, at the end of the day, obtain the rights to patents resulting from federally funded research – the government, or the recipient corporation[142]. One camp of politicians believed that patents for federally funded research should remain in the public domain because the fruits of such labor were financed by taxpayer money, and that handing patents over to industry would not only 'give away' these fruits, but would bolster the technological and economic might of the recipient industry. The other camp favored handing patent rights to industry because they argued that it would allow industry to commercialize useful discoveries and inventions financed by federally funded research. Sampat (2006) highlights another contentious issue during this era: lack of a standardized patent policy across various federal agencies. After World War II, each federal R&D funding agency had its own specific patent policies, which created a great deal of confusion for contractors and government employees. This scenario was cemented by each of the administrations of US Presidents Kennedy and Nixon who both believed that agency-specific policies were appropriate in light of the individualized patent missions of each agency (Sampat, 2006). Prior to the passage of the Bayh-Dole Act, universities wishing to obtain rights to patents resulting from federally funded research had to negotiate with the individual funding agency for an Institutional Patent Agreement (IPA) (Sampat *et al*, 2003) – a bureaucratic process that did not necessarily grant exclusive rights[143].

However, the passage of the Bayh-Dole Act in 1980 provided a standardized and expedited patent policy process for the university (and small businesses) that

[142] During this period, and indeed throughout much of the 20th century, universities were historically reluctant to engage in patent and licensing activity largely due to the fear that such a practice would erode their historic institutional mission of public knowledge dissemination and 'open science' (Sampat, 2006).

[143] Sampat (2006) reports that the IPA was introduced in 1968, and was the predecessor of the Bayh-Dole Act of 1980. The IPA was enacted following the results of two reports released in 1968 – one by the US General Accounting Office (US GAO) and the other by the consulting firm Harbridge House – that examined the federal patenting policy in the context of university-pharmaceutical company collaborations in the 1940s and 1950s. Then, pharmaceutical companies often screened novel therapeutic compounds on behalf of the university that discovered them, using federal funds from the National Institute of Health (NIH). Occasionally, depending on the patent policy of the university, a collaborating pharmaceutical company would be granted exclusive rights to develop and market a researched compound. However, this practice was frozen in 1962 by the Department of Health, Education and Welfare (HEW) when they enforced universities to have collaborating pharmaceutical companies sign formal patent agreements that barred companies the rights to patents resulting from technologies discovered on NIH funds. The US GAO and Harbridge House criticized this move by HEW because they argued that this ruling disincentivized pharmaceutical companies from screening compounds because the companies would be unable to obtain the rights to patents for their in-house work. The IPA was essentially a compromise on the part of HEW in that it preserved universities' full rights to patents whilst allowing them to license their patents (hence grant some control of their research) to pharmaceutical companies.

granted them full rights to patents resulting from research funded by any federal agency in addition to the freedom to license patents on an exclusive or non-exclusive basis (Sampat *et al*, 2003; Sampat, 2006). The Act was introduced without much resistance because of the increased emphasis at the time on US competitiveness, as highlighted by the journal *Science* (1979: 479; cited in Sampat, 2006) who wrote that 'industrial innovation has become a buzzword in bureaucratic circles … the patent transfer people have latched onto the issue'. As Sampat (2006) notes, the Act largely relieved any stigma previously associated with the business aspect of university patenting and licensing, as well as any potential political embarrassment associated with university patenting that prevailed throughout much of the 20th century. The Bayh-Dole Act heralded a new era of university 'entrepreneurialism'[144] and 'economic dynamism' that was especially pertinent at a time when the state was preoccupied with propelling its position in an increasingly competitive global economy (Sampat, 2006: 780).

Sampat (2006) presents statistical data on two indicators – 'technology transfer' and 'university patenting' – which are essentially barometers for Bayh-Dole Act usage by the university. Sampat (2006) presents compelling empirical data showing a clear correlation between the introduction of the Bayh-Dole Act in 1980 and an upsurge in the year of entry for university technology transfer activity. Similarly, Tyfield (2008) reports an eightfold increase in university technology transfer offices between 1980 and 1995. Additional empirical data presented by Sampat (2006) shows a similar trend for the practice of university patenting. It was an insignificant practice prior to and throughout the 1970s, and then – coincident with the introduction of the Bayh-Dole Act in 1980 – mushroomed to nearly 1,600 university patent applications in the 1990s from less than 100 prior to the 1970s. Consistent with this trend, Tyfield (2008) reports three consecutive doublings of university patents in the periods 1979-1984, 1984-1999, and 1989-1997. In terms of revenue, and according to a survey conducted by the Association of University Technology Managers (AUTM), universities in 1991 earned close to $200 million in license revenues – a value that has increased seven-fold since that time (Sampat, 2006).

[144] For compelling empirical evidence of university entrepreneurialism, see the anthropological work of Vallas and Kleinman (2008) who, researching in the context of university-industry alliances, publish interview excerpts of scholars and researchers working in the university or industry.

Vallas and Kleinman (2008: 289) cite how 'state policies', with an earlier mention of the Bayh-Dole Act, contributed to the 'co-evolution of previously separate organizational fields' in reference to academic and corporate science; in other words, the forging of university-industry alliances. Examples of such a trend include: the popular establishment of small start-up pharmaceutical research firms by former university faculty; the rise of collaborative scientific research initiatives between the university and industry, as reflected for example in the increase in the volume of publications co-authored by university and industry researchers; and the greater mobility between the university and industry as exemplified in the practice of the latter recruiting young PhDs, or undergraduate students for summer internships, from the former. This is just a sampling, Vallas and Kleinman (2008) note[145], of the many new and distinct ways in which the university and industry have forged alliances. Furthermore, such university-industry alliances, or at least the greater breadth and volume of them in the last few decades, were undoubtedly an outgrowth of the university's exploitation of the Bayh-Dole Act.

Crucially, drawing on my discussions in Chapter 3 about economic rivalry, one would think that the patenting of university *internal research data*, spurred by the Bayh-Dole Act and other likeminded neoliberal policy initiatives, essentially confers a degree of *rivalry* to the patented knowledge. This is so because consumption by the researcher from the university research lab that holds the patent rights to a given knowledge creates a situation where they inhibit simultaneous consumption of this very same knowledge by all those who do not hold the patent rights to it (unless the patent holder(s) authorizes use of their patented knowledge by some or all individuals). Such a scenario has serious ramifications for knowledge dissemination in the context of learning in the university research lab because patented knowledge in this context is *sequestered* from the public sphere of academe. Indeed, Johns (2006) draws on sociologist of science Robert Merton's classic 'norms' of scientific conduct (1942)[146] to claim that 'communalism' (essentially the degree of *non-rivalry* of a

[145] See also Phan and Siegel (2006); online resource from the *Rensselaer Working Papers in Economics* available at: http://ideas.repec.org/p/rpi/rpiwpe/0609.html (last accessed 7/29/2012).

[146] These norms include: *universalism*, which refers to transcending various boundaries – gender, race, age, cultural makeup, etc. – in order for scientists to *equally* participate in scientific research; *disinterestedness* refers to the objective and unselfish undertaking, and goal, of scientific research; *communalism* is the expected culture of sharing scientific ideas, methods, and results, within the scientific community; and *organized skepticism*

given piece of knowledge) is the most fundamentally implicated norm in the context of patenting university knowledge. Johns (2006) argues that the incentive function to succeed in science has evolved from one historically based on 'honor' to, nowadays in light of university patenting, 'economic reward'. Furthermore, scholarly research is nowadays premised upon royalties earned from the practice of licensing patents, and not 'reputation' as was formerly the case (Johns, 2006). On Merton (1942), Johns (2006) goes on to note that

> progress itself, he implied, depended on the repudiation of trade secrecy that this norm enshrined in the scientific community. 'The communism of science', Merton therefore warned, 'is incompatible with the definition of technology as ''private property'' in a capitalistic economy' – and with contemporary uses of patents in particular (Merton 1942, p.275). (Johns, 2006: 146)

This excerpt provides a prelude, in upcoming chapters, to the types of contentious issues surrounding the patenting of university *internal research data*.

Technology transfer: the emblem of university entrepreneurialism

Davidson (1971) gives a general definition of *technology transfer* as the transfer of technical information from one institution to another, with the adaptation and successful use of the transferred information by the recipient institution. More specifically, and in the current professional context of the university, the AUTM captures the commercial potential of technology transfer by defining it as 'the process whereby inventions or IP from academic research are licensed or conveyed through use rights to industry' (AUTM, 1998: 3; cited in Carlsson & Fridh, 2002). This definition clearly encompasses the university's enactment of the Bayh-Dole Act. It is no surprise, then, and consistent with the data presented above, that the explosive growth in the number of TTOs in American universities is concurrent with the introduction of the Bayh-Dole Act in 1980; university TTOs soared from 25 in 1980 to 200 in 1990 to, nowadays, where almost *all* universities have a TTO (Nelson, 2001).

Whereas the Bayh-Dole Act represents the *immaterial* policy arm of the university IP process, it is the university TTO and its staff that represent the *material*

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refers to the democratic critique and scrutiny of one's own and that of fellow scientists' research, particularly in light of the preceding norms (Bencze *et al*, 2007).

arm through which the Bayh-Dole Act is enacted. The university TTO – the physical office space located within the university campus that conducts actual technology transfer (Carlsson & Fridh, 2002; Phan & Siegel, 2006[147]) – provides the appropriate administrative and legal infrastructure required to manage the application, maintenance, and licensure of university patents, and the university's IP portfolio in general. Carlsson and Fridh (2002) employ a comprehensive empirical study comprising mail questionnaires and telephone interviews with several American university TTOs to better understand the technology transfer process. From the many universities examined in their study, Carlsson and Fridh (2002) report that a given technology transfers process typically commences with the submission by a university researcher of an 'invention disclosure form' to the university TTO. On receipt of this form, the TTO assesses the economic risk-benefit ratio of the application, taking into account such factors as the cost of IP[148] protection of the information in question, as well as the potential economic gains that could ensue from licensing the IP. Drawing on their empirical data, Carlsson and Fridh (2002) construct a general, four-stage protocol for how the university typically obtains an IP license, once IP for a given *internal research data* has been obtained. We now take a look at this protocol, with each stage contextualized in accord with my own profession (in italics):

1. **Confidentiality or Non-Disclosure Agreement (NDA**) (1-2 days). This is a legal contract between the university and industry that stipulates the disclosure of confidential information (pertaining to the IP in question) between the two parties, but not to third parties. This disclosure allows substantive negotiations between the two parties to

[147] Online resource from the *Rensselaer Working Papers in Economics* available at: http://ideas.repec.org/p/rpi/rpiwpe/0609.html (last accessed 7/29/2012).

[148] The TTO at the University of California at Irvine delineates four primary types of IP, any of which the website suggests may be filed by the university. *Patents* are granted by the US government to provide exclusive rights (usually for a period of 20 years) to an inventor (of a pharmaceutical drug, e.g.) in exchange for public disclosure of the invention. However, the patent-protected invention is protected from unlawful use in the public domain insofar as the 'right conferred by the patent grant is the right to exclude others from making, using, offering for sale, or selling the invention in the US'. *Copyright* is a form of protection granted by the US government to 'original works of authorship' – published or unpublished – that encompasses literary, dramatic, musical, artistic, and certain other intellectual works, and more specifically includes items as wide-ranging as maps, architectural depictions, computer programs, photographs, and motion pictures, for example. Copyright law generally allows the copyright holder to reproduce and disseminate their copyrighted work among the general public. *Trademarks* are a type of branding in the form of a 'service mark' that exclusively tags a tradable item (or service) as having a unique source or origin, and which distinguishes the trademarked item from goods provided by others. A *trade secret* is highly lucrative information – such as a 'formula, pattern, compilation, program, device, method, technique, or process' – the potentially high economic value of which is preserved when its secrecy is maintained, otherwise it could be exploited by others. (Source: http://www.ota.uci.edu/fac_intellect.htm - last accessed 7/29/2012.)

take place. *In the current professional context, the confidential information conveyed by the NDA could be* internal research data *that details the molecular structure and mechanisms of a novel drug that effectively cures a debilitating human disease. Such information is highly lucrative because of its obvious commercial value to alleviate human suffering and potentially save human lives. Therefore, the confidentiality of the document detailing the drug must be contractually secured by the NDA so as to avoid appropriation of the data by competitors who could exploit the information before our lab is able to do so*.

2. **Business Plan**. This document confirms for the university the intellectual, economic and technical resources of the licensee. Such resources are essential to successfully exploit the IP in question into a commercially viable product. *In the current professional context, the university TTO may investigate the financial history and commercial success of the pharmaceutical company Novartis as a potential licensee of our IP. The TTO may investigate various aspects of Novartis's operations in their assessment of Novartis as a suitable licensee, including:* intellectual and practical capabilities *to optimize the drug's mode of action, as well as to refine its bioavailability, and to lengthen its physiological stability in the patient;* processing plant capabilities *to successfully scale-up manufacture of the drug; and* marketing capabilities *to successfully advertise the manufactured drug to physicians and the general public.*

3. **License Term Sheet**. This document outlines the tentative agreement of the terms (including economic) of the proposed license. *In the current professional context, this may include the explicit cost to Novartis of licensing our IP that contains the blueprint for the drug, as well as agreed royalty payments to the inventor and our university that arise from eventual sales of the drug (see Rai & Eisenberg, 2003).*

4. **License Agreement** (weeks to several years). This final document in the process incorporates both the economic and other terms of the License Term Sheet including the university's general licensing terms and conditions. The authors' study reveals that a TTO licensing associate and the inventor are typically involved in the negotiations required by this document. Carlsson and Fridh (2002) report that one university TTO adopted a proactive role in seeking potential licensees through, for example, reaching out to potential corporate clients; this is consistent with Etzkovitz and Goktepe (2005: 4; my emphasis) who state that the TTO evolved 'from a relatively passive entity focused on legal aspects of patenting to a proactive focus on marketing'. *In the current professional context, this final document solidifies the technical and economic agreement between Novartis and our university regarding the licensing of the IP containing the blueprint for our drug. It may involve negotiations between Novartis, our university (as represented by our university's TTO), and the principal investigator of our lab in which the original drug discovery was made.*

As we can see, the university TTO is the crucial connection that links the university – historically perceived to be a non-profit entity – to the corporate world; indeed, Macho-Stadler *et al* (2007) state that the creation of a TTO within the university is instrumental for developing university-industry relations. From the above empirical data of Carlsson and Fridh (2002), we see that the university technology transfer process is a laborious one. It is a multi stage process that can potentially prolong for several years, especially at the final stage of License Agreement. Furthermore, each stage of the process appears to be deeply entrenched in complex administrative, legal, and economic matters that demand specialist resources from the university; along these lines, Bercovitz and Feldmann (2006: 175) note the 'economic, social, and political influences that shape the ability of universities to both create new knowledge and deploy that knowledge in ways that are economically useful to firms'. The pivotal importance of technology transfer to the university is underscored by the fact that the university's annual budget for patenting and licensing activities can be as high as $2 million, and that the director of the TTO

reports directly to prominent members of the university such as the Vice President for Research or the Provost (Carlsson & Fridh, 2002).

All the above university activities in the context of technology transfer are emblematic of university entrepreneurialism. Consequently, the boundaries become blurred between the university as a strict academic institution, and industry as a strict commercial enterprise:

> universities assume entrepreneurial tasks such as commercializing inventions … companies take on academic roles such as sharing knowledge among each other and with universities. (Etzkovitz & Goktepe, 2005: 2)

University entrepreneurialism in the context of technology transfer gives us a flavor of the type of fundamental change that the university has experienced in postmodernity, and which we explore in more detail in the next chapter.

Before wrapping up this section, I want to draw on Bercovitz and Feldmann (2006) who construct a conceptual framework comprising economic, social, and political forces that govern knowledge-based economic development in the context of technology transfer. The *social* input of their model comprises the 'individual researcher', which is equivalent to my lab researcher role as part of my dual professional responsibilities as a 'lab researcher' and 'lab educator' in the university research lab. Bercovitz and Feldmann (2006) note that the neoliberal 'tightening of university budgets and competition for the relatively fixed pool of public funding create incentives for scientists to engage in entrepreneurial activity' (Bercovitz & Feldmann, 2006: 180); i.e., technology transfer[149]. Here, we see the manifestation in the university research lab of the neoliberal *control* technology of 'responsibilising the self' (see chapter 4) – highlighting the permeation of neoliberal *control* technologies across all aspects of contemporary life.

That the university lab researcher is forced to 'responsibilise' herself was obvious the very instant I was handed a lab notebook upon beginning my job. What was once a humble notebook intended for the scientist to *objectively* record her experimental data has evolved into a highly-prized 'book of ideas' that is additionally

[149] Indeed, engagement in technology transfer is incentivized by the university TTO with royalty distributions. For example, see the University of Arizona's royalty distribution policy at: http://www.ott.arizona.edu/content/royalty-distribution-policy (last accessed 7/29/2012); notice how the university lab researcher is seen by the university in an entrepreneurial light – i.e., as 'inventor'.

intended for the scientist to *subjectively* record, in meticulous detail, all her experimental hypotheses and *ideas*. That way – as it was explicitly made known to all new lab personnel during lab notebook training – there would be no legal ambiguity in the eyes of patent attorneys regarding which individual or institution thought of a potentially patentable idea first. Indeed, the first few pages of the lab notebook are laden with the language of technology transfer – it includes terms like 'information ownership', 'rights', 'property', and 'patenting'.

But there is resistance among some university lab researchers towards the practice of patenting. Bercovitz and Feldmann (2006) shed light on some of the social forces that influence whether or not a researcher engages in technology transfer. For example, drawing on Thursby and Thursby (2002), Bercovitz and Feldmann (2006) cite three potential barriers to this practice on the part of the lab researcher working in American higher education: 1) a reluctance to engage in the necessary R&D that is sometimes demanded by some industry buyers of academic research; 2) publication delays on research data that are necessary to lure potential industry buyers (because presumably publication prior to patenting renders the research vulnerable to copying); and 3) the general feeling that technology transfer represents an inappropriate commercialization of science that prioritizes patenting over publication of research data. These contentious issues, and others, will be explored in more detail in Chapter 7.

Hard, soft, control: the 'technological triumvirate'

We now close this chapter, and this first phase of the dissertation, by revisiting the key concepts of preceding chapters to show how these concepts collectively cultivated the conditions that led to the formation of a *technological triumvirate* of university-industry alliances:

First, empirical evidence presented in Chapter 3 provides a clear role for ICTs in the transition in the late 20th century of society to a knowledge-based economy. Chapter 3 further argues that the archetypal *hard* ICTs of the TV and the radio, telephone, satellite, and PC, helped pave the way for a knowledge economy in the context of the university because they collectively provide an increased capacity to

store and *manipulate internal research data*[150]. Increased knowledge *storage* and *manipulation*, recall, constitute the first two criteria of my threefold *heightened knowledge conveyance framework* – a prerequisite for labeling a given technology an 'ICT'. I proposed that the TV and the radio, in particular, through their continual broadcast of knowledge-containing programs like news and documentaries, helped cultivate in the university a cultural ethos (albeit largely implicit) of the transition of society to a knowledge economy. This was key for the university's political, economical, and cultural preparedness and restructuring for the then approaching knowledge economy.

Second, drawing on Chapter 3, the cognate *soft* technology of each of these *hard* ICTs helped pave the way for a knowledge economy in the context of the university because they provide an increased capacity to *disseminate internal research data*. Increased knowledge *dissemination*, which constitutes the third criterion of my threefold *heightened knowledge conveyance framework* of ICTs, is mediated by a given *soft* technology (e.g., radio waves in the case of the *hard* technology that is the satellite). ICT-mediated *heightened knowledge conveyance* provides fertile ground for a knowledge economy because it fuels the scarcity-defying nature of knowledge thereby rendering it a forever available, abundant, mobile, and, within the context of IP law, lucrative global commodity. Recall from closing arguments in Chapter 3, that the cognate *soft* technology of the above *hard* technologies, because of their ability to render knowledge weightless, were collectively the key catalyst that triggered the transition of an economy that historically has always partly been based upon the production and sale of knowledge – including that during the industrial revolution – to a literal 'knowledge economy' as we know it today. Hence, *hard* and *soft* technologies that gave rise to a knowledge economy set the *technological* stage for the *technological triumvirate*.

Third, drawing on Chapter 4, the political doctrine of neoliberalism is a paradoxical *control* technology. It is 'paradoxical' because while neoliberalism supposedly represents a revival of the main tenets of the *democratic* political

[150] Relative to knowledge conveyed by the conventional means of a textbook in an era that predates the advent of ICTs; for example, the industrial revolution.

movement of classical liberalism, it is, unbeknownst to the public, a *control* technology that undemocratically *controls* the individual along the lines of a strict state-fabricated free-market order that instrumentally reduces the individual (including lab educator and student) to a mere 'standing reserve' (Heidegger's concept, 1977). Therefore, the individual is controlled by the neoliberal state as a *means*, or 'standing reserve', for the neoliberal state *end* of optimal market efficiency, with a consequential reduction in state expenditure, as well as propulsion of the state's ranking in the highly competitive global capitalist economy. Hence, the *control* technology of neoliberalism set the *political* stage for the *technological triumvirate*.

Fourth, and finally, and drawing on this chapter, exploitation by the university of a knowledge economy through the sale of its select *internal research data*, in the context of the past (and present) pervasive neoliberal culture of privatization, has become a dominant trend in higher education in late 20th century. Crucially, the neoliberal policy of the Bayh-Dole Act, enacted by the university's TTO, propelled the university to the position of primary purveyor of its IP to industry; this opened the doors of the university to additional entrepreneurial ventures with industry, and the *technological triumvirate* of university-industry alliances was born.

Thus, the university's sale of its select *internal research data* as IP, and the licensing of this IP to industry, may be conceived as a product of our *technologizing world*. The impact of this practice on everyday learning in the university research lab – the very sphere from which the knowledge in question is sourced – is explored in Chapter 7. But first we turn to Chapter 6 to explore how university-industry alliances and attendant postmodern forces have seriously brought into question the historically perceived notion of the university as a *public* institution. These postmodern forces have collectively given rise to a nowadays fundamentally reconfigured institution that we may refer to as the 'postmodern university' (see, e.g., Smith & Webster, 1997), which we now explore.

6

Local to the global: the changing face of the 'university'

> The University of Excellence serves nothing other than itself, another corporation in a world of transnationally exchanged capital. (Readings, 1996: 43)

This chapter opens with an epigram from Bill Readings' influential book *The University in Ruins* (1996). Readings captures the profound structural changes occurring to the modern university in a society that has succumbed to the forces of global capitalism. He refuses to call today's university 'postmodern', instead opting for 'posthistorical' to more accurately reflect the notion that the university has outlived itself[151]. A common theme of the

[151] Readings' (1996) stance that the contemporary university has 'outlived' itself may be warranted when one exclusively examines (as Readings does) the *philosophical* evolution of the university over time from its inception to the current day, otherwise such a viewpoint seems overly radical. Furthermore, the fact that Readings rejects the notion of the contemporary university being 'postmodern' is entirely contrary to my own upcoming

posthistorical university is the 'University of Excellence', which Readings (1996) defines as a 'techno-bureaucratic institution' that ultimately evolved from, and hence betrays, the ideals of Humboldt's 'University of Culture' rooted in German idealism. Readings argues that 'excellence' is a 'non-referent', or arbitrary term, that forces all aspects of the university to be measured along corporate, rather than intellectual, lines.

Readings' epigram also captures the highly globalized world that we now occupy; the increasing global presence of the university[152] – the notion of which is reflected in the title to this chapter – is no exception to this trend. In short, we are witnessing the radical evolution of the university from a public nation-state-centric institution to nowadays (on many levels) a private global-centric business. It is this marked evolution that, I believe, has given rise to the *postmodern university* – the central argument of the chapter.

The university as a historical public sphere

In this section of the chapter I draw a crucial, and as we will see later striking, parallel between the *bourgeois public sphere* – a concept formulated by Habermas in *The Structural Transformation of the Public Sphere* ([1962] 1991)[153] – and the public sphere of the university[154]. 'Public sphere' has many, often competing, philosophical connotations[155], but my use of it here is narrow and specific. It is my reference to the *historical* perception of the university as a non-profit academic institution that is, for the most part, free from any sort of corporate agenda[156]. Indeed, Thornton (2009:

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argument that is compellingly premised and which, crucially, draws on the founding figure of postmodernism, Jean-François Lyotard (1984).

[152] An important distinction should be noted here, for Eckel *et al* (2004) state that the university is both 'old hand' and 'newcomer' to globalization. It is 'old hand' because of its commitment to the global content of its curricula, as well as the international mobility of its students and faculty; the university is 'newcomer' to globalization in the many ways that we will explore in the course of this chapter.

[153] Habermas's (1991) primary purpose of this work was to make people cognizant of the apparent erosion to the critical public sphere in contemporary consumerist culture (Gestrich, 2006).

[154] The historical emergence of the American university is the product of a variety of international influences that can be traced primarily to an original colonial model imported from England that was combined with the German research university idea introduced in the 19th century; see Altbach, 2004. See also Gould (2003) who cites the US Morrall Acts of 1862 and 1890 that enabled the creation of land-grant institutions.

[155] See, for example, Parkinson (2006).

[156] My use of 'corporate agenda' refers to the specific and narrow research, production, and marketing goals of a given corporation; for example, the corporate agenda of the pharmaceutical company Novartis Vaccines (i.e., 'industry') is to focus on the design, manufacture, and marketing of a narrow selection of vaccines to prevent various human diseases. Here, industry operating under the framework of capitalism has a *discriminatory research agenda* because the specialized nature of corporate products, and the narrow demographics to which they are targeted, funnels the research down a specific narrow path. The university, on the other hand, is apparently

376; my emphasis) argues that 'for centuries, the university has been viewed as the custodian of culture, the seat of higher learning and the *paradigmatic site of free enquiry*'; similarly, Readings (1996: 6) states that the 'university … exists to inculcate the exercise of critical judgment'. Using Habermas (1991) as a framework, I aim to identify partial erosion of the 'public sphere' of the university research lab as a result of the university's engagement in technology transfer. Recall, technology transfer is part product of the *hard* and *soft* technologies of a knowledge economy, and the *control* technology of neoliberalism; indeed, Marginson (2005) specifically cites the market-driven forces of a 'knowledge economy' and 'neoliberalism' as testing the university's degree of 'publicness'.

Before proceeding, we should note that Parkinson (2006) makes an important distinction between the 'metaphorical', versus the 'physical', public space[157], where the former is often embraced by the field of social theory, and includes specific examples like the media, internet, and social networks. Parkinson (2006: 1) appreciates the advantage of the metaphorical public space because 'members of large-scale, complex societies cannot all gather together in a physical forum to argue, deliberate and decide'. Moreover, he highlights the potential of the metaphorical public space to unveil implicit power disparities that are inscribed in spatial forms.

But Parkinson's (2006) paper is a call for the re-appreciation of the *physical* public space, which, according to him, has been forgotten in light of all the hype over the metaphorical public space. Parkinson argues that the 'physical public space matters because of the functional necessity of physical arenas for democratic action' (Parkinson, 2006: 1). Moreover, I would like to point out that many metaphorical public spaces are dependent on, and grounded in, a specific physical public space[158].

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free from any sort of 'corporate agenda' because its research goals are open and multidisciplinary; they span, in a given university, several schools of thought or 'faculty', under which there are several departments, within which the research is broken down into numerous sub-specialties. Furthermore, the *trajectory* of university research has historically been (for the most part) geared towards open and free intellectual inquiry whereby researchers are entirely free to apply for federal funding to finance their own *personal* research interests – free from corporate steerage. So, although there may be (like industry operating under a capitalist framework) discriminatory research at the individual university researcher level, it is not the case if we look at the multidisciplinary nature of the university at the *institutional* level. Crucially, the university's free, open, and *non*-discriminatory research agenda, in addition to its open capacity for intellectual discussion and debate, rightly renders it the major (perhaps ultimate) 'public sphere' of society.

[157] For the purpose of this chapter, 'public space' is synonymous with the 'public sphere'.

[158] But not all metaphorical public spaces are grounded in a physical public space. For example, a real-time internet forum comprising a multinational group of individuals debating about politics represents a metaphorical public space, but such a space is not grounded in a physical one. For the participants are not, and were not, a *physical collective* in the same close proximity (i.e., the notion on which a physical public space is premised); rather, the participants are located – as *spatially separated* individuals – at their respective computers with which they are using to partake in the forum.

For example, the metaphorical public space of the virtual, online learning forums for this EdD programme[159] – shared by myself, my peers, and my professors – depends on the physical public space of the university boardroom wherein the forums were originally conceived among the directors of the EdD programme. Mindful of this distinction, we now take a look at Habermas's *bourgeois public sphere*, before applying it to the current professional context of the university research lab.

In the period prior to the emergence of a public sphere (around the 17th century and prior), Habermas (1991) argues, the then feudal state sought to represent itself through art and culture (Duvenage, 2005). This totalitarian state essentially sought to represent itself to the public through hierarchal symbols of social status (as opposed to words), that included the wearing of certain insignia (badges, arms); adhering to a strict noble etiquette (formal protocols of social conduct); and engaging in formal discourse (formal addresses to the people) (Habermas, 1991). In this so-called *representative public sphere*, the '"lord" was "public" by virtue of representation' (Habermas, 1991: 13); anything of a lower social status to the lord (i.e., the general public) was simply not represented (Habermas, 1991). The striking hierarchy between the state as 'ruler', and the individual as 'ruled', is underscored by Gestrich (2006) who notes that

> in the early modern period the people functioned merely as an 'environment' for the ruler's demonstration of splendor and power. Their political participation was reduced to the role of bystanders in the streets, when the princes 'represented their lordship not for but "before" the people'. (Gestrich, 2006: 416; quoting Habermas, 1991: 8)

Therefore, the *representative public sphere* did not constitute an actual physical social realm or public sphere as such (Habermas, 1991); rather, its function was to provide a mere platform for the spectacle of the state's authority (Nathans, 1990).

Habermas (1991) traces the emergence of the public sphere to around the 17th century when a bourgeois constitutional state emerged against the backdrop of a

[159] 'Public', that is, to all the members of the EdD program who are free to express their intellectual thoughts on any subject, in any forum, at any time. So the meaning of 'public' does not extend to the *entire* human, or even school, population because every public space apparently has a philosophical demarcation that defines a certain predefined group of individuals that are admitted to, and can be entirely 'public' within, a specified public space. In the current example, that predefined group of individuals is the 'EdD community' who are 'public' in the context of the EdD program. When I say 'are "public"', I mean that there is, within the public space of the EdD community, a presupposed democratic 'freedom of expression without restraint' that is free insofar as it operates under an assumed commonsensical culture of respect and social etiquette.

burgeoning capitalist order. It is no surprise, then, that the awaking of a public sphere – which essentially embodies a *democratic* culture of rational discussion and debate – is coincident with the emergence of the democratic political movement of classical liberalism in the 17th century (see Chapter 4). Essentially, a *bourgeois public sphere*[160] arose in the modern era from a *representative public sphere* in the feudal era (Duvenage, 2005). Other forces that helped precipitate the formation of a public sphere included the granting of private property rights to individuals, which allowed the individual to assert their authority as 'property owner'; an increase in political debate; a rollback of press censorship; an opening of the doors of parliamentary sessions, first to the press, and then to the general public; and the growth in the number of sociocultural venues – for example, coffee houses, salons, literary journals, and newspapers – that enabled the general public to engage in critical discussion and debate (Nathans, 1990; Baynes, 1998). Gestrich (2006) argues that Habermas (1991) overlooked the formation of a modern media-based printing press – and the network of postal routes required for its distribution – as a crucial factor in the transformation of early modern political culture, and in turn, the creation of a public sphere.

Drawing on Habermas (1991), Duvenage (2005) states that the rise of the public sphere can be traced to two distinct phases of 'rational-critical' practice, the first of which was the *literary public sphere*:

> The identification (*Empfindsamkeit*) with the characters in the bourgeois novel and drama, the importance of a rational-aesthetical debate in salons, journals, and newspapers, and the educational role of the art critic all contributed to the institutionalization of the literary public sphere as some kind of a *Vorform* [predecessor] of the political public sphere. (Duvenage, 2005: 4)

Consistent with a revived faith in democratization at the time under the political banner of classical liberalism, Habermas (1991; cited in Duvenage, 2005) distinguishes three 'institutional criteria' of the literary public sphere that are egalitarian in nature. These included: 1) a complete 'disregard of social status' that 'far from presupposing the equality of status, disregarded status altogether' (Habermas, 1991: 36); 2) a domain of 'common concern' whereby any subject, including those that were previously unchallenged, was entirely open to being probed at a time when the church and state were no longer seen as the ultimate source of

[160] That the 'public sphere' comprised primarily the bourgeois has been challenged; for example, Gestrich (2006) cites several scholars who believe that the bourgeois of the 'public sphere' more accurately comprised elites, civil servants, academics, and priests, and just a handful of bourgeois.

philosophical or aesthetic authority; and 3) 'inclusiveness' in the sense that any 'propertied and educated' individual with access to literary material could participate in a debate so indiscriminate that power cliques apparently failed to form.

That the first, *literary*, phase provided a forum for subjects of common concern that could be carried over into political discussion and public policy, led to the transition of the literary public sphere into the *political public sphere* (Nathan, 1990; Duvenage, 2005). The nature of the debates, instead of being of the artistic and literary kind that characterized the literary public sphere, were more politically orientated in the sense that they questioned the arbitrary political motives that began to shape bourgeois society at the time (Kellner, online resource[161]). As Baynes (1998, online resource) writes, the political public sphere functioned 'to restrain and legitimate the political power exercised by the administrative state'. In sum, the public sphere bridged the private space of civil society – comprising the *family*, which shaped people through values, norms, religion and personal experience, and the *workplace* – with the realm of state power (Metzler, 1997). The public sphere comprised private people who came together to engage in public rational discussion (Habermas, 1991).

In the very way that capitalism created the bourgeois public sphere, it also precipitated its decline. According to Habermas (1991), capitalist society transitioned from a culture of *rational discourse*, which so eloquently defined the public sphere, to one of passive *consumption* (Nathans, 1990; Duvenage, 2005). This shift – central to the decline of the public sphere – occurred in the last quarter of the 20th century when liberal capitalism evolved into the cartels and protectionism that characterized the rise of contemporary capitalism (Duvenage, 2005). Kellner (online resource) writes that corporations came to control and manipulate both the media and state, while the state's increasing role in society dissolved the demarcation between 'public' and 'private', resulting in a 'refeudalization' of society (Habermas, 1991). The effects on the public sphere are profound. Kellner (online resource) writes that in the now debased public sphere, 'public opinion is administered by political, economic, and media elites which manage public opinion as part of systems management and social control'. The decline of the public sphere is exacerbated by the economic and political motives of the modern mass media whose social engineering of the

[161] Available at: https://files.pbworks.com/download/vrjFrFPEqL/knowledgepublic/13684704/Habermas_Public_Sphere_Democracy.pdf?ld=1 (last accessed 7/29/2012).

population – via advertising, marketing, and public relations, for example – shape voting behavior and consumption patterns among consumers (Duvenage, 2005). Even the supposed democratic process of the modern political system of western nations has become victim to the decline of the public sphere. Gestrich (2006) notes that the electorate's reaction to political parties oscillates rather naively – hence, *uncritically* – between simple 'acclamation' or 'disapproval' in response to political campaigns that 'feed' images to the electorate, as opposed to complex critical debate that intellectually and philosophically engages and challenges the electorate.[162]

We now turn to the university which I place in relation to the *bourgeois public sphere*. Recall that the *hard* and *soft* (Chapter 2) technologies of a knowledge economy (Chapter 3), and the *control* (Chapter 2) technology of neoliberalism (Chapter 4), collectively created the technological and economic conditions, respectively, that prompted the university to begin (in the late 20th century) the routine sale of its select *internal research data* to industry. The university practice of technology transfer, and other novel business alliances between the university and industry resulting therefrom, represents an additional source of revenue for the university in a neoliberal era of marketization of higher education. But a disturbing new trend may be emerging as a result of university-industry alliances: 'in higher education today corporations not only sponsor a growing amount of research – they frequently dictate the terms under which it is conducted' (Press & Washburn, 2000: 297).

For example, a highly publicized and controversial case study concerns the University of Berkley which, in 1998, forged a multimillion dollar agreement with the pharmaceutical company Novartis (Press & Washburn, 2000). Novartis agreed to pay the university $25 million to finance plant-based research; in exchange, Novartis was granted priority to negotiate licenses on a third of *all* research discoveries made in the research department – including those *not* financed by the Novartis deal. Additionally, the award of two of the five seats on the University's research

[162] Despite significant contributions to many diverse scholarly disciplines, Habermas's concept of the *public sphere* is not without its critics. For example, a glaring deficiency of Habermas's supposedly egalitarian public sphere is its exclusive bourgeois composition. But what about the proletariat and plebian demographics marginalized by the public sphere (see Nagt & Kluge, 1993)? And not to forget women who, ironically, at the time of Habermas's writing were engaged in a revived social uprising (Ryan, 1992). The answer to such criticisms, Kellner (online resource) writes, may lie in conceiving a *multiplicity* of overlapping and potentially conflicting public spheres that reflect new social movements and technological transformations of the time.

committee gave Novartis considerable leeway in deciding the academic research agenda (Press & Washburn, 2000)[163]. But this could become problematic when industry, like Novartis, conducts and reports research that reflects its narrow commercial interests[164]. A specific empirical study published in a peer-reviewed journal shows that 98% of drugs researched with industry funds are painted in a favorable light, compared to just 79% of drugs researched with non-industry funds (Press & Washburn, 2000).

Press and Washburn's disturbing report (2000)[165] is peppered with numerous likeminded anecdotal accounts demonstrating a clear encroachment of the American university's public sphere by industry. Mindful of this encroachment, I now argue that the university[166] may be loosely likened to the *bourgeois public sphere* (Habermas, 1991)[167]:

First, I propose that the public sphere of the university is theoretically and chronologically analogous to the *literary public sphere* (Habermas, 1991)[168]. Central to the analogy is the notion that both actors – the *bourgeois* in the public sphere, and the university lab *researcher* – engage in unrestrained rational-critical discussion as a defining democratic characteristic of this sphere. In the university research lab, this typically translates into freedom of the researcher to apply for federal funding to finance the research of her choosing[169], as well as to openly discuss her *internal research data* with peers, present it at external conferences, and publish it in peer-reviewed journals.

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[163] It is these types of business alliance between the university and industry that are supplementary in nature to, and often ultimately stem from, university technology transfer – see Chapter 5.

[164] This is reflected at the university institutional level with the downsizing of humanities departments and the upsizing of science departments, especially those that produce research that translates into commercially viable pharmaceuticals (see Press & Washburn, 2000; Blackmore, 2003). See also my conception of a *discriminatory research agenda* in footnote 156.

[165] Available at: http://www.aaas.org/spp/rd/ch26.pdf (last accessed 7/29/12).

[166] More precisely, the current professional context of the university research lab; I cannot speak for other departments as I do not work in them.

[167] I emphasize 'loosely' because my argument merely draws from the *overarching* points of Habermas's (1991) thesis, and as such, does not capture (and therefore does not do justice to) its many philosophical nuances.

[168] It appears that only the *American* (not the European) university is chronologically consistent with the emergence of a bourgeois public sphere because it emerged around the beginning of capitalism (with the exception of a few older institutions like Harvard University, which was founded in 1636 and therefore *predates* the beginnings of capitalism). Indeed, Wittrock (1993; cited in Kwiek, 2000: 75) strongly alludes to the co-emergence of the university and capitalism when he states that 'universities form part and parcel of the very same processes which manifests itself in the emergence of an industrial economic order'.

[169] That is, within the theoretical constraints of the research department in which the researcher works.

Second, I propose that the social mobilization that sparked the evolution of the literary public sphere into the *political public sphere* (Habermas, 1991) outside the university also occurred, by analogy, *inside* the university. Indeed, Ambrozas (1998: online resource), in reference to the university, states that with the 'birth of the new social movements during the 1960s and 1970s … politics was put on the academic agenda'[170]. Central to the analogy is the notion that both actors become cognizant of and question the modus operandi. For example, the realization among the scientific community that neoliberal policy sparked, at the time, an increasing dependency of the university on industry funding for its research in a new era of university entrepreneurialism (Moore *et al*, 2011).

Third, I conceive that industry steerage of the university research agenda, as reported by Press and Washburn (2000), represents a *partial*[171] decline of the public sphere of the university that is strikingly analogous to the decline, in contemporary capitalism, of the *bourgeois public sphere* (Habermas, 1991). Faithful to the original concept is the individual who evolves from a *rational* thinker in the bourgeois public sphere to a passive *consumer* shaped by corporate and media interests during the decline of the public sphere (Habermas, 1991). By analogy, we may be witnessing the evolution of the university lab researcher from an intellectually creative and self-exploratory actor – i.e., a *rational* thinker – in the public sphere of the university, to a passive actor whose research agenda is heavily predetermined by the commercial interests of industry[172] in the era of the *technological triumvirate* of university-industry alliances.

Thus, the historical existence of the university public sphere, and what we now see as the partial encroachment of it by industry, is analogous to Habermas's (1991) *bourgeois public sphere* (Habermas, 1991). Crucially, the commonality prompting the decline of, or at least 'erosion' to, both the *university* and *bourgeois public*

[170] Ambrozas' (1998) feminist critique calls for a capitalization of the increased social fragmentation and politicization of the contemporary university in order to assist her, and others, in the deconstruction of a pervasive male gender bias in what she considers to be an 'elite' institution. Ambrozas' loose analogy (1998) between the *bourgeois public sphere* and the public sphere of the university provided me with the original inspiration for this section of the chapter. However, Ambrozas' approach is quite different. Her analogy focuses on the university *as a whole* – not the current professional context of the university research lab. Also, her analogy is vague, unlike the more specific theoretical constructions that I present here.

[171] I say 'partial' as to not suggest in any way that *all* public spheres of *all* universities have *fully* declined.

[172] See footnote 156 regarding industry's *discriminatory research agenda*.

spheres is late capitalism. Late capitalism is manifested by, for example, the modern mass media and corporations in the case of the public sphere, and I conceive the political doctrine of neoliberalism in the case of the university[173].

The decline of the bourgeois public sphere comes with the apparent decline of rational-critical discourse, and hence democracy (Habermas, 1991). In strikingly similar fashion, we see that the decline of the university public sphere as a result of *technology transfer* – a central expression of the *technological triumvirate* of university-industry alliances – comes with an apparent decline in democracy because free scientific inquiry, learning, and dissemination are, in some instances, steered by the overriding monetary motives of industry[174]. Aside from this somewhat dystopian picture of the university being 'victim' to technology, it is important to realize the many positive contributions of technology to the promotion of democratic public spheres not just within the university, but beyond with the help of the internet (see, e.g., Bohman, 2008).

Partial encroachment of the university public sphere by industry is just one of the many fundamental structural changes occurring in the university as a consequence of the *technological triumvirate* of university-industry alliances. In the next section of the chapter, we explore other key fundamental structural changes occurring in the university as it adapts to the highly market-driven era of neoliberalism. Such changes, I claim, collectively give rise to a fundamentally reconfigured institution that we may call the *corporate university*.

[173] For neoliberalism as both an expression, and a key driver, of late capitalism, see Chapter 4.

[174] That the *unrestrained* ability of the professor to perform these freedoms (which essentially equate to *academic freedom*) is inextricably tied to democracy is evident upon reading the 1940 *Statement of Principles on Academic Freedom and Tenure* of the American Association of University Professors (AAUP; see next section in this chapter). In reference to academic freedom, it reads (my emphasis): 'The common good depends upon the free search for truth and its free exposition … freedom in research is fundamental for the protection of the rights of the teacher in teaching and of the student to freedom in learning. *It carries with it duties correlative with rights'*; full statement available at: http://www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm (last accessed 7/29/2012).

Characteristics of the 'corporate university'

> There may be uncertain financial times ahead for all universities, but I am confident we will strive forward, to the benefit of researchers, students and society, not only in Glasgow but also across the globe[175]. (Principal of Glasgow University Professor Anton Muscatelli speaking in the university's 2009-2010 *Annual Review*)

Waks (2002) distinguishes three types of *corporate university*: 1) established, mainstream *non-profit* universities adapting to new economic and technological pressures by adopting the managerial practices of for-profit corporations (e.g. the University of Boston); 2) *for-profit* universities that satisfy the necessary political and legal criteria for Federal university accreditation (e.g., The University of Phoenix); and 3) relatively new educational organizations that provide in-house training and development for employees of *for-profit* corporations (e.g., McDonald's Hamburger University), and which award degrees through accredited universities (either one of the first two types).

For the purpose of the dissertation, we are primarily concerned with the first definition of *corporate university*[176] for I believe it accurately describes the changing nature of most contemporary American universities as they adapt to 'economic' and 'technological pressures'; i.e., neoliberalism (a *control* technology) and a knowledge economy (the product of certain *hard* and *soft* technologies), respectively[177]. However, it is important to stress that Waks (2002) merely captures just one facet – i.e., the business function – of the contemporary university, in his first definition of which I use as a working model for the *corporate university*. However, unlike Waks, my purpose with this chapter is to draw on Waks (2002) as well as other scholars in order to capture a more *multi-faceted* picture of the contemporary American university.

[175] This quote from the principal of a Scottish university, not an American one (the focus of the dissertation), is intended to convey the global mindset of the contemporary university – not just here in America, but abroad; that is, global institutions, serving a global market, competing within a global capitalist economy. The quote additionally highlights the economic and cultural volatility of the contemporary university; Glasgow's future position, as noted by Muscatelli, remains to be seen.

[176] Whenever I refer to 'corporate university' I more accurately mean '*quasi*-corporate university'. I use the prefix *quasi* to denote that the university embodies many, but not *all*, the characteristics of the corporation such as, for example, strict profit-making (if we adhere to the first definition of *corporate university* in the text above).

[177] More accurately, I should say that the university has not just responded to the emergence of a knowledge economy and neoliberalism, but has actually *utilized* these key technologies to its advantage, as we have seen with technology transfer (see Chapter 5).

With these definitions in mind, we now turn to Schultz (2004, online resource[178]) who makes an analogy between the university and Macpherson's (1997) characterization of liberal democratic societies. According to Macpherson (1997), such societies are caught between two competing expectations for their citizens: 1) the individual as a rational, 'social creature'; and 2) necessitated by the competitive capitalist economy that is the hallmark of liberal democratic societies, the individual as a 'consumer'. In striking similarity to Macpherson's distinction, Schultz (2004) goes on to argue that the modern American university (and higher education generally) has historically been caught between these two opposing mandates. On the one hand, consistent with the notion of a liberal arts education and the educational philosophy of John Dewey, is the university imperative to cultivate pragmatic, self-developing and democratic citizens (a view also echoed by Bok, 2003; cited in Delbanco, 2007[179]). On the other hand, consistent with the educational philosophy of Horace Mann, is the university imperative to cultivate skilled and productive laborers (not necessarily consumers) for the workforce.

Traditionally, these opposing philosophies have been more or less kept in balance throughout the history of the American university. But this balance has apparently now tipped – brought on by the (strongly alluded to) policies of neoliberalism, and the knowledge-commercializing forces of a knowledge economy[180] – *towards* a more market-orientated model. This imbalance, Schultz argues (2004), has nowadays given rise to the *corporate university*[181]. Schultz states that the

> corporate university, unlike the commercialized one, is an institution that seeks to fulfill its accumulation function by stripping itself of its democratic function and fully adopting its capitalist function by both serving the market and participating in it at the same time. In effect, the causes of a university becoming corporatized are endogenous to higher education, not exogenous. (Schultz, 2004, online resource)

Schultz's (2004) above reference to the *commercialized university* is confusing. For if we are to adhere to the earlier three definitions of *corporate university*, a *commercialized university* (Schultz, 2004) is presumably one that does *not* adopt the

[178] Available at: http://www.logosjournal.com/issue_4.4/schultz.htm (last accessed 7/29/2012).

[179] Online resource available at: http://www.nytimes.com/2007/09/30/magazine/30wwln-lede-t.html?pagewanted=1&adxnnlx=1309622405-wjo6S/wemY82EG8Cfje6yA (last accessed 7/29/2012).

[180] The author specifically cites the 'Bayh-Dole Act'; see Chapter 5.

[181] Aside from the 'fiscal crisis of the state' (discussions of which strongly allude to the market-driven policies of neoliberalism and a knowledge economy), Schultz (2004) argues that the emergence of the *corporate university* has been exacerbated by an 'ideological war' launched by the far-right against (their perception of) the exceedingly liberal agenda of the American university.

business practices of for-profit institutions, but nevertheless advertises, or at least promotes, its degrees via brochures and prospectuses (justifying the label 'commercialized'). But, and this is where I think Schultz's definition is unclear, at what point does a *commercialized university* become a *corporate university*? That, I suggest, occurs when the university attempts to *gain a greater market share* relative to other universities (now 'competitors'), and it is 'market share' that is precisely what Schultz (2004) is referring to when he says 'accumulation function'[182]. Schultz (2004), in the above quote, basically means that the American university nowadays embodies a corporate culture that historically existed exterior to it; the university in the past merely *served* the market by providing it with a competent workforce in the form of educated citizens. The university is nowadays corporate, or is at least 'corporat*izing*', because it both serves *and* participates in the market. To see the many ways in which the university is a participant of the market, I use Schultz's paper (2004) and others in the literature to explore the key characteristics of the *corporate university*. Crucially, these characteristics are largely unprecedented in the history of the American university and, accordingly, mark the switch to a corporate entity:

The first characteristic of the corporate university, and a key ingredient in its making, is its nowadays increased dependence on corporate sponsorship in light of decreased federal funding for higher education (Schultz, 2004). A key example is the *technological triumvirate* of university-industry alliances – of which technology transfer is emblematic. Indeed, Press and Washburn (2000) report that industry funding for the university skyrocketed from around $850 million in 1985 to $4.25 billion less than a decade later. Schultz (2004) additionally reports on the incidence of what I see as the unprecedented practice of *product placement* in (and by) the university of industry's brand or logo that often occurs as a condition when the former receives funding from the latter.

For example, Press and Washburn (2000) report on the pervasive presence of corporate logos in the University of Berkeley's Haas School of Business as a result of business relations with various companies. The school forged business relationships

[182] The 'accumulation function' cannot be 'profit' if we are to adhere to the first (of the three) earlier definitions of the *corporate university*; in the first definition, the university is 'corporate' insofar as it models its business practices after *for-profit* corporations – not because its goal is to make profit. Nevertheless, it is difficult to imagine – especially in light of the current neoliberal era of reduced federal funding for the university and ensuing entrepreneurial ties with industry – that a *commercialized university* is *not* a *corporate* one; i.e., its primary business function is *not* to gain a greater market share, following this conception of mine.

with Donald Fisher, the founder of Gap, whose company features in an introductory business course in the school, while the 'Bank of America Dean of Haas' was created out of the school's business connections with the bank.

The university does not just bear the brand of corporate sponsors – but also that of itself. Bunzel (2007) reports on the deployment by the American university of various costly corporate marketing strategies to improve its ranking in an increasingly competitive higher education market. For example, a chunky white 'H' on a crimson backdrop – propagated on a plethora of university-branded university gift shop merchandise like clothing, stationary, and even candy – has (at least here in the US) become instantly associated with 'Harvard University'. Here, as Readings (1996) notes, university branding is intimately tied to corporate identity.

Yet another characteristic of the corporate university concerns the American Association of University Professors (AAUP). The AAUP was founded in 1915 by a group of academics including Arthur Lovejoy and John Dewey. It is an organization run by American academics that has historically sought to promote and preserve the democratic ideals of academic freedom ('the capacity to speak without fear in the public arena'; Blackmore, 2003: 11) and faculty tenure in the university (see Fruman, 2009). But Schultz (2004) cites serious erosion of the democratic nature of the 'shared governance' model of the AAUP, in which faculty have historically been granted equal voice in the direction of university policies as wide-ranging as curricula content to faculty appointments. Schultz (2004) claims that the organizational structure of the AAUP is increasingly being replaced by a top-down (hence, hierarchal) mode of governance akin to a corporate board of trustees in industry (see also Clawson & Mishy, 2008)[183].

Acknowledging these findings, Nelson (2006, online resource[184]) speaking in the AAUP's *Academe* magazine warns of the 'grave challenges' faced by faculty and AAUP members. His warning collectively concerns the transfer of shared power away from faculty and towards centralized administrations; the threat to academic tolerance and faculty tenure in light of the rise in adjunct or 'contingent faculty'

[183] Interestingly, the *Chronicle of Higher Education* reports that half of university presidents from 40 of the top American research universities serve on a company board (Giroux, 2011; online resource available at: http://truth-out.org/index.php?option=com_k2&view=item&id=69:beyond-the-swindle-of-the-corporate-university-higher-education-in-the-service-of-democracy - last accessed 7/29/2012).

[184] Available at: http://aaup.org/AAUP/CMS_Templates/AcademeTemplates/AcademeArticle.aspx?NRMODE=Published&NRNODEGUID={846EC02B-06AD-4929-925F-90E372E2C608}&NRORIGINALURL=%2FAAUP%2Fpubsres%2Facademe%2F2006%2FND%2FCol%2Fftp.htm&NRCACHEHINT=NoModifyGuest (last accessed 7/29/2012).

(because fulltime faculty are costly to employ and difficult to remove should their research specialty be deemed to lack market value; see Press & Washburn, 2000; Blackmore, 2003; Schultz, 2004)[185]; decreased tolerance of on-campus political dissent; and the university's increased selection to prospective students and adult learners of vocational degree programs[186].

Finally, 'local to the global' in the title to this chapter is intended to emphasize the increased global presence of the university. Increased global presence usually refers to either the operation by the university of an entirely separate satellite campus (or campuses) abroad, or the franchising by foreign higher educational institutions of a domestic university brand and products in a process sometimes called 'McDonaldization of the university'[187] (Altbach, 2004). In this sense, the university sounds uncannily like the aggressive business expansion ambitions of the corporate world. Relatedly, *curricular joint venture* (CJVs) – a classic example of *cross-border education* (see Knight, 2003) – describes the university's exploitation of new markets to generate additional revenue (Eckel *et al*, 2004). CJVs entail the creation of new academic programs (often technologically-delivered) that are entirely conceived from alliances either among different universities, or between the university and industry (or non-profit or non-governmental organizations)[188]. Eckel *et al* (2004) cite three drivers of this entrepreneurial process:

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[185] See also McGee (2002) who provides a compelling personal reflection of her experiences as an adjunct faculty member at New York University. McGee (2002) writes that her all-consuming passion for teaching was undermined by the demoralizing demands of the adjunct faculty position – an overworked and underpaid position through which the university strategically harnesses the free evening time of working professionals engaged in full-time day jobs. This business structure is economically and administratively efficient for the university – but not, according to McGee (2002), for the adjunct faculty member. McGee's (2002) insight into adjunct faculty life is an uncanny reflection of my own adjunct faculty position at Cambridge College, Massachusetts, which I, too, walked away from precisely because of those reasons cited by McGee (2002).

[186] For example, the often costly degree (for the student) of Masters in Business Administration (MBA) – the huge growth in demand of which has been part fuelled by the increased interest in the workplace for managerial positions in a knowledge economy – has become a 'cash cow' for the university as it seeks additional ways to recoup revenue (Schultz, 2004). Moreover, online delivery by the university of the MBA program has, relative to on-campus degree programs, kept low the teaching costs of the program as well as enhanced the market penetrability of the program by making it available to a potentially global market. Yet another vocational degree program on the rise in the university is the professional doctorate in business or education (such as this one), which, according to Fink (2006), was born out of a deficiency in the theoretical and practical applicability of the traditional doctorate (PhD) to professions in a knowledge economy. Citing Gibbons *et al* (1994), Fink (2006: 37) writes that the professional doctorate is largely characterized by the pursuit of 'mode 2' knowledge which is non-hierarchal, transient, multidisciplinary, and 'operates within the context of application', thereby rendering it highly applicable to a knowledge economy. 'Mode 2' knowledge transcends the hierarchal, objective, and regimented knowledge structures that characterize 'mode 1' knowledge, the generation of which is exemplified by the traditional doctorate.

[187] So-called presumably because it mirrors the franchising business structure of the fast-food restaurant chain McDonald's.

[188] One of the many examples of CJV listed by the authors was, at the time of their writing, Cardean University which was part of a multi-university collaboration (that included the London School of Economics) to deliver various online degree programs in business.

1) 'the hunt for revenue, prestige and quality' (Eckel *et al*, 2004: 301) paints the university as an aggressive business player that competes with other universities for a larger chunk of the student market in new era of university entrepreneurialism. An indispensible source of revenue for the university, aside from technology transfer and industry sponsorship, is the rising cost of tuition fees. As a reflection of the increasing privatization of American higher education, empirical data reveals that tuition fees skyrocketed by 439% between 1982 and 2007 – despite meager and highly disproportionate rises in median family income (Lewin, 2008[189]). In this scenario, the *student* – nowadays forced to finance university degree products with hefty debt – is increasingly perceived as *consumer*.

2) The 'potential of the curriculum' describes the university's entrepreneurial exploitation of 'capital' contained in its curricula through, for example, intensive summer school programs or corporate training. Key to the 'potential of the curriculum' is a shift in emphasis from *knowledge production* (as in the case of technology transfer) to *knowledge dissemination* (Eckel *et al*, 2004: 302)[190]. I extend 'the potential of the curriculum' to the boom in the university provision of online learning and online degree programs – the number of students enrolled in an online course rose from around 10 percent in 2003 to around 30 percent in 2009 (Christensen & Horn, 2011). Online learning is cheaper for the school because, compared to on-campus teaching, fewer professors can teach a larger number of students (Schultz, 2004). Moreover, online delivery enables the university's curriculum to transverse vast geographic boundaries to reach a potentially global market. And

3) 'the global growing student market' (Eckel *et al*, 2004: 303) reflects the increasing global demand for higher education. The university's drive to tap into this trend is motivated by a desire to increase its revenue through new student enrolments in global niche markets, as well as to boost its global exposure as part of its corporate branding process (see earlier)[191].

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[189] Online resource available at: http://www.nytimes.com/2008/12/03/education/03college.html (last accessed 7/29/2012). Such is the gravity of the situation, Lewin (2008) reports that the empirical data of the National Center for Public Policy and Higher Education predicts that the soaring cost of higher education may, in years to come, be unaffordable for most Americans, with the poorest of students disenfranchised the most.

[190] Relatedly, Eckel *et al* (2004) report on the practice whereby the various individual roles of the professor – for example, curriculum design, teaching, assessment, etc. – are each assigned to individual experts in a conveyor belt-like production process in an attempt to increase efficiency and product consistency, and to streamline instructional activity.

[191] The increasing global presence of the university is undoubtedly contributing to its 'massification', which is consistent with Munene's (2008: 1) definition of 'massification' as 'acceleration and expansion of higher

Now that the concept of the *corporate university* has been explored, we conclude this chapter by constructing the concept of the *postmodern university* – the theoretical making of which, I will argue, is built by the collective actions of the *hard*, *soft*, and *control* technologies outlined in previous chapters.

Hard, soft, control: the makings of the postmodern university

Nazi Germany, third world hunger, racism, eurocentrism, global terrorism; this is a mere sampling of the many unsettling world events and atrocities (most of which are artifactual[192]) that seriously question the supposed rational 'order' of the modern era (Burke, 2005). Consequently, some scholars (notably Lyotard, 1984; see upcoming discussions) argue that the pillars on which the grand unifying theories of society are supported – a central defining feature of modernity – appear to be crumbling. It is this collective lack of faith in the 'progress' that modernity promises that has apparently caused our departure from modernity, and our corresponding entrance into *post*modernity.

In the same way that the actual *era* of postmodernity embodies a sense of cultural instability, or at least non-linearity (see Bodi & Maier-O-Shea, 2005)[193], so too does a stable and robust working definition for the actual *term* of postmodernity. For example, Bertens (1995: 12; cited in Cheek, 1999) writes that 'postmodernism has been a particularly unstable concept. No single definition of postmodernism has gone uncontested or has even been widely accepted'[194]. Nevertheless, Adams (1997, online resource[195]), also noting obfuscation surrounding the meaning and use of the term,

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education and increased access to it'. Meanwhile, in light of a knowledge economy, Kwiek (2000) cites the governmental push for 'life-long learning for all' as fuelling massification of the university.

[192] Being 'artifactual' – i.e., human-made – suggests a potential *control* technology property to some of these unsettling word events. Recall, from Chapters 2 and 4, that the primary criteria for a *control* technology are their dual *unconscious* and *undemocratic* dimensions. Indeed, using the first example, and with a basic understanding of world history, Hitler's fascist regime was undoubtedly *undemocratic*, as well as *unconscious* in light of Hitler's many mesmerizing public addresses to his people.

[193] For example, the advent of modern, frequent, and cheap air travel has enabled mobilization in the masses of various cultural groups, ethnicities, and populations across their indigenous borders resulting, in any given (often urban) global location, a sense of rich cultural heterogeneity. This phenomenon is exacerbated by various other modern technologies, such as those examined in Chapter 3, which seem to miraculously bend the physical laws of time and space, leading to the coinage 'space-time compression' (see, e.g., Mitchell, 1999). As a result, the predictable linearity of modernity appears to have shattered.

[194] Adding further confusion, Adams (1997; online resource available at: http://www.crosscurrents.org/adams.htm - last accessed 7/29/2012) states that 'postmodernity' and 'postmodernism' are two distinct terms. The former is used predominately by social scientists to refer to a cultural condition or state of being, while the latter is used predominately by artists and humanists to refer to a cultural movement or 'plurality of movements within culture'.

[195] Available at: http://www.crosscurrents.org/adams.htm (last accessed 7/29/2012).

lists four broad characteristics that, although not exhaustive, may assist our understanding of (but are not necessarily intended to define) 'postmodernity':

1) 'decline of the cultural superiority of the west', as manifested for example in the linguistic turn, the trend in abstract art, and challenges to western democratic political theory such as neo-confucianism and Islam. These factors are symptoms of decline presumably because they represent a threat to the stable and dominant cultural mainstays that collectively defined the superiority of the west (e.g., the increasing presence of Islam seems to strengthen the nowadays depopularizing image of Christianity in the western world). This idea relates to metanarratives, which we turn to next;

2) 'the legitimation crisis', which refers to delegitimation (or at least decreased faith in) the overarching theories, or 'metanarratives', that supposedly confer stability to society, such as the notion of 'the afterlife' as conveyed by the Christian bible. The nowadays collective lack of faith in metanarratives has supposedly resulted in a society with a 'pluralism of values and value systems with each competing against the others' (Adams, 1997, online resource). Moreover, there has been a supposed shift in modernity from a decreased faith in overarching authoritative knowledge primarily grounded in objective positivism, to postmodern notions of truth primarily grounded in historically-, politically-, and culturally-dependent relativism (see McNeill, 2006)[196].

3) 'the intellectual marketplace', which appears to overlap with some elements of Habermas's capitalist decline of the public sphere (1991), refers to the switch in control of cultural and religious knowledge and values by the intellectual and political elite (e.g., that teachers largely controlled their students) to nowadays control by the modern mass media and telecommunications[197]. And

4) 'deconstruction', which is to not simply accept texts at face value, but rather to dissect their myriad of meanings as shaped by the highly contextual circumstances and social situations at the time of writing. Deconstruction, then,

[196] Indeed, for some (e.g., Young, 1997; Talen, 2002) *postmodernism* is synonymous with the epistemological stance of *relativism*, such that the two sometimes appear in the academic literature as the compound term 'postmodern relativism'. But this is an extreme exemplification of postmodernism for not all postmodernists advocate absolute relativism (see, e.g., Sayer, 1993). Also note that a lighter version of positivism (which ordinarily rejects relativism in favor of singular overarching truths or theories), called *postpositivism* (see, e.g., Kuhn, 1962), responds to recent criticisms of the limitation of the application of the scientific method to social science research by actually advocating relativism (see Phillips & Burbules, 2000).

[197] See also the radical theories of Baudrillard (e.g., 1995) who argues that the predominance of symbols and signs in our current (postmodern) media-laden world substitute actual reality.

'categorically asserts the absolute impossibility of attributing to any text one single ultimate meaning' (Adams, 1997, online resource).

But absent from Adams' list (1997; and also that of Sayer, 1993, who compiles a likeminded list) is any explicit singular reference to contemporary capitalism. For if we are to understand Lyotard (1984), a central theme of postmodernity is the notion of knowledge as a technologically-mediated lucrative global *commodity* that is traded on a *capitalist* market. Indeed, Woods (1997), like Kellner (2002), emphasizes the inextricable link between postmodernism and capitalism. Woods (1997) notes that several theorists, such as Fredric Jameson and David Harvey, view the switch from modernity to postmodernity as merely a passage from one phase of capitalism to another, and ensuing cultural changes associated with this switch:

> Postmodernity then corresponds to a phase of capitalism where mass production of standardized goods, and the forms of labour associated with it, have been replaced by flexibility: new forms of production – 'lean production', the 'team concept', 'just-in-time' production, diversification of commodities for niche markets, a 'flexible' labour force, mobile capital and so on, all made possible by new informational technologies. Woods (1997: 540)

But to singularly view postmodernity as merely a switch to a different phase of capitalism disregards the many technological, political, economic, and cultural forces that *contributed to that switch* – such as those outlined by Adams (1997), above. Indeed, technology (namely cybernetics) forms a crucial theme in Lyotard's (1984) interpretation of postmodernity, to which we now turn[198].

A philosophical narrative of postmodernity was famously proposed by the French philosopher Jean-François Lyotard in his book *The Postmodern Condition: A Report on Knowledge* (1984). In this short but highly influential work, Lyotard's working hypothesis states that 'the status of knowledge is altered as societies enter what is known as the postindustrial age and cultures enter what is known as the postmodern age' (Lyotard, 1984: 3). 'Postindustrial' refers to highly developed societies that are nowadays heavily knowledge-based owing to the rapid and mass technological manipulation and mediation of knowledge; 'postmodern' refers to the

[198] The following paragraph on Lyotard is adapted from my *Educational Policy* module assignment for the EdD program.

consequent altered status of knowledge and its legitimation in such societies. Lyotard goes on to state that 'transformations which, since the end of the 19th century, have altered the game rules for science, literature and the arts' (Lyotard, 1984: 3). 'Transformations' refer to rapid technological advance in postindustrial societies in the post-World War II era, and the profound impact these transformations had on the two principal functions of knowledge – 'research', and the 'transmission of learning' (de Alba *et al*, 2004). Transformations are built upon the disciplines of language and information processing in a cybernetic-permeated society wherein 'the miniaturization and commercialization of machines is already changing the way in which learning is acquired, classified, made available and exploited' (Lyotard, 1984: 4). These transformations emerged amidst an 'incredulity toward metanarratives' (Lyotard, 1984: xxiv), which is a reference to humanity's collective disillusionment with the metanarratives of modernity. As noted earlier, metanarratives are grand unifying stories that cultures tell themselves about their own practices and beliefs in order to legitimate them, and were formulated on the enlightenment notion of empiricism and reason, whose shared goal is truth (Peters, 2004). Drawing upon Ludwig Wittgenstein's concept of 'language-games' ([1953] 2001), Lyotard (1984) argues that the 'game rules' of technology have their ultimate goal not in truth, but in the efficiency of minimizing the various inputs (i.e., knowledge authenticity, accuracy, or even robustness) and maximizing the desired outputs (i.e., profit from this knowledge sold). In the postmodern condition, then, knowledge becomes a commodity that is legitimated through the technological criterion of maximum market efficiency; this central defining tendency of knowledge markets is what Lyotard calls 'performativity' (Lyotard, 1984; Alba *et al*, 2000), and it must be kept in mind for my upcoming argument.

So if we briefly depart the current professional context of the university research lab to look at the modern mass media, a good working example of Lyotard's performativity thesis is demonstrable with what I see as the precedence by American network news of their selective broadcast of voyeuristic celebrity lifestyle stories over stories of more pressing social concern such as an ongoing humanitarian disaster. In this working example, the broadcast by network news of celebrity stories often appears to be amorally prioritized over more pressing social stories (this equates to the 'minimizing input' of performativity) in the interests of corporate profit because

the former apparently attract a greater viewership, and hence greater advertising revenue over the latter (this equates to the 'maximizing input' of performativity)[199].

Interpreting the writings of Lyotard (1984) confirms my own arguments made earlier in the dissertation. For Chapter 3 demonstrated that certain *hard* and *soft* ICTs of a 'postindustrial' era facilitated *heightened knowledge conveyance* that, in turn, was a primary causative force in the formation of a knowledge economy. The meanings behind my *heightened knowledge conveyance* concept and Lyotard's (1984) knowledge 'exchange' reference are very similar, although the latter, in its context, has a stronger connotation of 'economic transaction':

> knowledge is and will be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange. Knowledge ceases to be an end in itself, it loses its "use-value". (Lyotard, 1984: 4-5)

Therefore, knowledge becomes 'postmodern' because it is supposedly no longer legitimated by the universal knowledge paradigms of modernity – but rather by the monetary motives of the contemporary capitalist market. In the context of the university research lab, these monetary motives, as I conceive them, are the royalties earned from technology transfer.

We will return to Lyotard (1984) later, but before we do, we now turn to the American university in the context of postmodernity[200]. Building on Readings (1996), Kwiek (2000) cites globalization and the cultural passage to late modernity as primary dual forces responsible for the 'decline' of the modern university. Kwiek (2000) states that the American university (like the European one) was founded on the project written in 1808 by the German philosopher Wilhelm von Humboldt for the University of Berlin, which he founded. Crucially, the modern university was

[199] An example of Lyotard's (1984) performativity thesis in the current professional context of the university research lab will be presented in my upcoming argument.

[200] It is obvious from discussions in this chapter that the university is undergoing a radical transformation as it adapts to postmodernity. But is it really postmodernity that the university is adapting to? Delanty (2001: 587; cited in Blackmore, 2003) paints not one, but four pictures (all rather dystopian in nature), of the contemporary role of the university: 1) 'the entrenched liberal critique' views the university as a source of cultural reproduction; 2) 'the postmodern thesis' signifies the end of the nation-state, and along with it, the end of the university and its emancipatory capacity because of the collapse in metanarratives; 3) 'the reflexivity thesis' recognizes in the university a new mode of knowledge (namely, mode 2 type; see discussions earlier) that is sourced from a new reflexive relationship between the user and producer of knowledge working against the backdrop of a post-Fordist era; and 4) 'the globalization thesis' takes up on the theme of the *corporate university* to describe the instrumentalization of the university as it succumbs to, and indeed, actively embraces market modes of production. Therefore, it is important to realize that there exists a variety of theoretical viewpoints (some overlapping, some competing) concerning the ongoing transformation and future role of the university, and that I merely focus on just one – that being the *postmodern university*.

> born together with the rise in national aspirations and the rise in the significance of nation-states in the 19th century. A tacit deal made between power and knowledge on the one hand provided scholars with unprecedented institutional possibilities and, on the other, obliged them to support national culture and to help with constituting national subjects: citizens of nation-states. (Kwiek, 2000: 75)

Here we see that the overarching metanarrative of the modern university was the cultivation of national citizens. But with the rise of global capitalism – and the nation's reorientation towards it in order to maintain global competitiveness (see Chapters 4 and 5) – the integrity of the nation-state and, in turn (because the two are intimately tied) that of the modern university, are seriously questioned. Readings (1996) refers to the resulting institution as the 'University of Excellence'. Indeed, it is not difficult to find a university proclaiming some form of 'excellence' in its mission statement. For example, the mission statement of Boston University – my first internet search of a mere few seconds – proudly proclaims 'standards of excellence'[201] with regard to its founding principles. But what exactly does Readings mean by this coinage?

On analyzing Readings' (1996) concept of the 'University of Excellence', Webster (2009; online resource[202]) describes the university mission statement as a 'dearth of conceptions'. By this he means that the inevitable, sometimes pervasive, use of 'excellence' in the university mission statement – for example, 'excellent location', 'excellent libraries', 'excellent gym', 'excellent parking', and so on – ironically rob the university of any distinguishable conception of exactly who, or what, the university actually is. It seems that the 'excellence' word – abundant in glossy university marketing material like prospectuses and the 'annual report' – is a mere marketing device deployed by the university to entice prospective students to enroll at, and hence financially patronize, a given university. Webster (2009) argues that the apparent lack of any overarching concept (or modern metanarrative) of what or who the university actually *is* sits at the heart of the *postmodern university* – an institution that he calls an 'oxymoronic establishment, a collection of differences devoid of defining characteristics and no internal unity'. According to Webster (2009), the university has succumbed to the rapidly shifting, non-linear, and fluid

[201] Available online at: http://www.bu.edu/info/about/mission/ (last accessed 7/29/2012).

[202] Online resource available at: http://cjms.fims.uwo.ca/issues/07-01/Frank%20Webster.pdf (last accessed 7/29/2012).

forces of globalization, and which are a defining feature of the postmodern era. These forces are so profound that the theoretical demarcation between the university and society – that which has granted the university historical 'ivory tower' status – has diminished. Consequently, the university in its supposedly postmodern form has become an 'inside-out' institution in the sense that the very knowledge that it has historically generated and provided to society is, in light of knowledge workers working in a knowledge economy, increasingly being generated *outside* of its walls in the workplace[203].

With this foundation in place, I now draw on discussions in this chapter to offer a reconceptualized notion of the *postmodern university* that, to the best of my knowledge, is different from most others. Crucially, I demonstrate that the collective actions of *hard*, *soft*, and *control* technologies provide hitherto overlooked components that are critical for the philosophical makings of the *postmodern university*:

First, I argued that technology transfer results from the university's exploitation of a knowledge economy (collectively born from key *hard* and *soft* technologies; Chapter 3) through sale, in a neoliberal market (a *control* technology; Chapter 4), of its select *internal research data* to industry. Technology transfer opened the doors of the university to additional entrepreneurial ventures with industry, and the *technological triumvirate* of university-industry alliances was born (Chapter 5).

But this chapter reports that such entrepreneurial ventures can – as is demonstrable with the University of Berkley and Novartis case study – lead to encroachment of the university public sphere by industry in a manner analogous to the decline in contemporary capitalism of the bourgeois public sphere (Habermas, 1991). Indeed, Press and Washburn (2000: 310) state that 'as university-industry ties grow more intimate, less commercially oriented areas of science will languish'; in other words, industry science takes precedence over university science, which has

[203] For example, the corporate sector, including the pharmaceutical industry and engineering firms, conduct research of comparable rigor to that conducted in the university (indeed, many of those that work in industry are former university faculty). Similarly, government surveys and statistical analysis provide compelling knowledge on the human sciences of the sort that reports the behavior – employment, crime, marriage, consumption, for example – of their own citizens, while unique, often highly specialized and current, knowledge contributions are made by a multitude of think tanks and consulting firms (Webster, 2009). Webster argues that these contributions of the knowledge worker have in some ways eclipsed, and essentially rendered redundant, the specialized knowledge-generating functions of the university.

historically, in the context of the university public sphere, been *academically free* and *open*.

Therefore, the *technological triumvirate* – born from certain key *hard*, *soft*, and *control* technologies – is an indirect causation[204] of industry's encroachment upon the university's historic public sphere. Moreover, because technology transfer is the metaphorical key that opened the university door to other entrepreneurial relationships with industry, technology transfer may additionally be conceived as the entrepreneurial seed from which the notion of the *corporate university* grew.

Second, industry's encroachment upon the university's historic public sphere is a scenario – nowadays not uncommon in the American university (see Press & Washburn, 2000) – that reflects Lyotard's (1984) *performativity* thesis of knowledge legitimation in contemporary capitalist society. This scenario exemplifies Lyotard's (1984) performativity thesis because, as reported earlier, industry clearly has the potential to steer the university research agenda *away* from the university research lab's free and open academic research interests *towards* industry's own commercial motivations. *Internal research data* that the lab researcher generates on behalf of industry in such a scenario is compromised in the sense that the knowledge is not absolutely true to the research lab's original academic agenda because it has been steered by industry[205]; it represents the *minimizing input* of Lyotard's performativity equation. In the same scenario, industry's commercial motivation represents the *maximizing output* of the performativity equation because the ultimate goal of industry operating in a competitive capitalist economy is perpetual maximization of profit.

[204] It is indirect because, as we see from the above chain of events, it is not technology transfer per se that causes this result, but rather externalities stemming from it.

[205] I am not suggesting that this knowledge per se is untrue, but rather that it is not entirely *loyal* to the lab's academic research focus because it has been steered by industry. The validity of knowledge produced by industry, on the other hand, has been subject to intense scrutiny in the past few years. Namely, there have been a prolific and damning number of controversies regarding the fallacious or exaggerated marketing claims, as well as concealment of potentially deleterious clinical research data, made by industry regarding some its pharmaceutical products. One notable case concerns the anti-inflammatory drug Vioxx that was formerly manufactured by pharmaceutical company Merck. Vioxx was withdrawn from the market in 2004 amid safety concerns that it increased the patient's susceptibility to heart attack; indeed, BBC news reports that Vioxx may have been responsible for heart disease in hundreds of thousands of patients in the US alone since 1999. Merck was successfully sued in 2007 amid accusations that they were aware of such adverse side–effects associated with Vioxx (see full reports at: http://news.bbc.co.uk/2/hi/health/4203437.stm and http://news.bbc.co.uk/2/hi/business/6443259.stm - last accessed 7/29/2012). Writing in the *Lancet*, Horton (2004) states that 'the licensing of Vioxx and its continued use in the face of unambiguous evidence of harm have been public health catastrophes', going on to conclude that 'Merck … acted out of ruthless, short-sighted and irresponsible self-interest'. In this particular case study, and in the context of Lyotard's (1984) performativity thesis, it appears that the 'minimizing input' is knowledge authentication, or lack thereof, while the 'maximizing output' is corporate profit.

Third, and finally, my conceptualization of the contemporary university declines to incorporate theoretical threads of the *corporate university* – a move that I grappled with given the strong market tendencies of the contemporary university and the capitalist notion implicitly laden in Lyotard's (1984) *performativity* thesis[206]. Why does my concept of the *corporate university* not contribute to the theoretical making of the *postmodern university* – despite it apparently doing so numerously in the academic literature[207]?

Because, to the best of my understanding, *internal research data* produced by the *corporate university* (when examined as a sole concept, outside the context of postmodernity) is loyal to the university's research agenda; the lab research agenda is *not* steered by industry. However, an obvious exception to this rule occurs when the corporate university introduces academic products in accord with market demands. For example, Webster (2000) reports on the commercialization of recreational activities by the university by selling degree programs in, for example, 'tourism', 'golf course management', and 'intimate relations', explicitly noting that this trend is being driven by Lyotard's (1984) 'performativity'. Indeed, this trend could conceivably fit with the performativity equation in the sense that these academic programs undermine the university's true academic teaching and research agenda (representing the *minimizing input* to the performativity equation) in order to meet market demand and, ultimately, gain greater market share (representing the *maximizing output* to the performativity equation).

However, there is a crucial distinction between the *corporate university* and the university in the context of its public sphere encroached by industry (as an *authentic* example of Lyotard's (1984) performativity thesis, as argued above). For in the former case, the university is merely responding – at its own will – to the inevitable changing nature of society (neoliberalism, the advent of postmodernity,

[206] Assuming, that is, that the *technological triumvirate* – the ultimate cause of industry's encroachment of the university's public sphere – predates the concept of the *corporate university*. For if it did not, the inverse would be true; i.e., the *corporate university* predates the *technological triumvirate*. If this were the case, the *corporate university* as an umbrella concept encompassing the *technological triumvirate* (and not the sole concept of the *technological triumvirate* per se) would be the ultimate cause of the rise of the *postmodern university*. But I counter the notion that the *corporate university* predates the *technological triumvirate* because the latter is the embodiment of the entrepreneurial behavior that was necessary to give rise to the former. Therefore, as noted earlier, the *technological triumvirate* is a key ingredient of (and as such predates) the *corporate university*.

[207] The most obvious example being Readings (1996) whose book is an unambiguous reference to the *corporate university* and which (despite Readings rejecting the term 'postmodern') has become, among many scholars, synonymous with the *postmodern university* (see, e.g., Strickland, 2002).

etc.) and corresponding market demands by implementing its own necessary business initiatives and restructuring. In the latter case, industry is an *exogenous* force (with potentially questionable ethical business practices; see footnote 205 about Merck) that is responding to market demands by *proactively seeking*, and enticing with financial incentives, the university as a means to appropriate its intellectual resources entirely for its own commercial ends.

Thus, I have unveiled the changing face of the university. It is a decidedly postmodern face for, in the context of industry's encroachment upon the university's historic public sphere, it is loyal to Lyotard's *performativity* (1984) thesis of knowledge legitimation in postmodern society. Moreover, my notion of the *postmodern university* sets out to break with orthodox notions of the concept on two accounts.

First, I offer a novel formulation of the *postmodern university* that factors in the hitherto overlooked actions of the various *hard*, *soft*, and *control* technologies presented in preceding chapters that are crucial for its creation.

Second, my reformulation of the *postmodern university* declines to incorporate theoretical threads of the *corporate university*.

With regard to this second account, I appreciate that the concept of the *corporate university* has contributed significantly to the changing face of the contemporary university, which is why it was discussed at length in this chapter. But I close my argument by suggesting that it has done so more on an aesthetic, rather than on a philosophical level, precisely because it fails to fit Lyotard's (1984) performativity thesis.

7

Global to the local: learning in the postmodern university research lab

> we cannot teach another person directly; we can only facilitate his [or *her*] learning (Rogers, 1983)

We just learned of the first profound impact of the university sale of its *internal research data* to industry on American higher education: the rise of the *postmodern university*. This chapter explores the second impact: fundamental changes in the nature of learning in the university research lab associated with the rise of the *postmodern university*. In order to explore this impact, we must first understand what learning in the lab – assisted by my insights as a lab educator – entails.

Learning dynamics in the university research lab

Recall that I sketched in Chapter 1 an outline of the two major knowledge types of the university research lab – *external research data*, and *internal research data* – both of which are the primary source of learning for university lab researchers (i.e., my students). It will also be recalled that my students are primarily exposed, with my guidance, to *external research data* upon searching for and reading published scholarly articles obtainable from online bibliographic databases; exposure to *internal research data* occurs primarily upon my students' attendance to mandatory in-house lab meetings. But there is more to *internal research data* than just lab meeting.

My students' clarification of, or at least new insight into, a perplexing piece of their *internal research data* (such as an unexplainable graph trend depicting a time-lapse experiment), aside from lab meeting, is additionally gleaned from informal scientific discussions with myself and other peers, as well as informal one-on-one meetings with the lab principal investigator (PI). Such educational insights tend to happen more frequently (sometimes daily) than the more predictable and periodic lab meeting. Moreover, a crucial distinction regarding the nature of the *internal research data* presented by my students in lab meeting versus that presented to peers or the PI is that the data in the former is more historical in the sense that it has amassed over time, whereas the data in the latter is entirely novel (sometimes just graphed moments ago by the student who generated the data). It is this sort of novel research data that is casually exchanged among my students and the lab PI – which we will now refer to as *current internal research data* to highlight its newness, and to distinguish it from *internal research data*[208] – that fuels learning on the part of my students. Such learning is both *theoretical* as in my students' intellectual formulation of new scientific theories, and *practical* as in my students' optimization of existing, or the design of entirely novel, experimental approaches. Either way, such day-to-day learning in the lab demands (as with all professions) a highly tacit 'reflecting-in-action' (Schon, 1984) that is too complex to articulate in writing to the layperson here, as has been additionally underscored by Dasgupta and David (1994).

Suffice to say, *current internal research data*, and informal scientific conversation about it, is an immensely rich learning experience for my students who

[208] However, as to not sound contradictory, I adhere to my point made in Chapter 1 that exposure of the lab researcher to *internal research data* occurs *primarily* through attendance to periodic lab meeting because lab meeting represents the cumulative *sum* of all relevant and important data, including *current internal research data*, accrued over time.

generate the data, and whoever else in the lab is exposed to it. Indeed, *current internal research data* is of paramount importance because my students rely on their interpretation of it, with the help of my perspective, in order to steer the short-term research project trajectory. For if a given piece of data (or data set) of my students confirms, or at least suggests to confirm, a given experimental hypothesis, the lab continues to theoretically and practically explore (and fine-tune, if necessary) their grand scientific theory[209] to which the experimental hypothesis is loyal (see Colless, 1969), and the research project is invariably preserved. If, on the other hand, a given piece of data (or data set) of my students refutes an experimental hypothesis, the lab must reformulate their grand scientific theory (see Colless, 1969), and in some instances change direction by abandoning the research project altogether in favor of a new grand scientific theory. But either scenario engages robust learning among my students.

For a current research project must be fed with fresh intellectual vigor in order to keep the research project moving. Likewise, an entirely new research project requires fresh intellectual vigor in order to conceive an entirely novel grand scientific theory that must ultimately be tested empirically[210]. In both cases, prior knowledge provides the theoretical foundation for moving forward (Spens & Kovács, 2005).

This style of scientific inference by my students in the lab – a 'theory testing process' involving the deductive falsification or corroboration of hypothesizes by empirical testing (i.e., from general theoretical laws to the specific findings; Spens & Kovács, 2005: 377) – aligns with the 'hypothetico-deductive' model (Lawson, 2000; Schickore, 2008). This model largely belongs to the broader epistemological branch of postpositivism associated with Karl Popper (Cruickshank, 2007). In postpositivism, current knowledge is supposedly subject, at the point of acquisition and interpretation of additional data, to potential falsification; in this sense,

[209] 'Grand scientific theory' (or simply 'research project') is my reference to one (out of usually many) of a given lab's *overarching* scientific theories, the ultimate corroboration of which is typically attained (and often documented in a manuscript for publication) by the confirmation of several experimental hypotheses. For example, the grand scientific theory that compound 'A' inhibits replication of a given virus may be corroborated, in part, by the hypothesis that compound 'A' binds to, and hence blocks, the viral 'key' protein that the virus uses to 'unlock' the host target cell. This hypothesis can be tested experimentally by showing that compound 'A' and the viral 'key' protein bind to one another in a test tube; however, various other supporting hypotheses, and their empirical testing, would be required to make a more complete and convincing story.

[210] However, the ethnographic findings of French philosopher Bruno Latour (1979) would have us believe that experimental data generated in the university research lab is a mere product of various social constructions. Although I reject this radical viewpoint, as reinforced by these discussions, I nevertheless appreciate that social constructs play a pivotal role in the political dynamics, outcomes, and motives, of many university lab researchers; indeed, much of the content of the dissertation is testament to this.

'knowledge is not based on unchallengeable, rock-solid foundations – [rather] it is *conjectural*' (Phillips & Burbules, 2000: 26; original emphasis)[211]. The search for knowledge is motivated by the most convincing warrants[212] at the time – in my case our lab's collective *internal research data* as well as that from other labs published as *external research data*. Postpositivism, then, is a nonfoundationalist approach that contrasts to the two foundationalist approaches of *empiricism* and *rationalism* – largely associated with René Descartes and John Locke, respectively – that defined western epistemological thought up until the end of the 19th century (Hjørland, 2005).

Two points are to be made from these discussions. First and foremost, my students' generation of *current internal research data* is an ongoing event that continues to self-educate my students and all members of the lab. Second, I wish to highlight the highly systemized nature of my students' learning concerning the interpretation of *current internal research data*; such learning is, as I understand it, how learning *should* be in the university research lab. So what happens to my students' learning concerning *current internal research data* in the *postmodern* university research lab – an institution shaped by the forces of various *hard*, *soft*, and *control* technologies? In order to answer this, we first take a lesson from Nussbaum (1997).

Nussbaum's (1997) landmark book *Cultivating Humanity: A classical Defense of Reform in Higher Education* is a rigorous and compassionate defense of contemporary curricula reform in liberal education; namely, the rise in the American university of undergraduate introductory courses in philosophy, often mandatory, that encompass diverse topics of pressing social relevance such as women's studies, African-American studies, and sexuality. Such courses have come under fire from radical right-wing groups who argue that their content threatens the social and political status quo. But Nussbaum believes that such philosophy courses unleash the

[211] However, I contest the notion that all knowledge, at least in the context of lab research, is 'fallible'. For example, clearance by the body of a given viral infection as substantiated by determination of the crystal structure of a molecular complex comprising a pharmaceutical compound bound to a viral protein whereby the former inhibits entry of the latter into the host target cell is, indeed, very real and 'true' knowledge. Although not definitively authoritative – because there will always be some 'holes' or incompleteness with this knowledge, as with *all* knowledge – I suggest that a more fitting label to describe such robust cause-and-effect knowledge is 'pending', which not only reflects the relative accuracy of the knowledge, but its inherent incompleteness in light of the fact that more knowledge layers will inevitably be added to it in due time (provided research continues on it).

[212] 'Warrants' is derived from 'warranted assertability', which is a term proposed by Dewey (1938) to be used in lieu of 'truth' in order to presumably reflect the open-ended and nonfoundationalist nature of knowledge; see Phillips and Burbules, 2000.

full intellectual potential of the partaking student because they catalyze engagement in a critically reflective – hence, intellectually robust – Socratic inquiry that is central to a successful democracy[213]:

> failure to think critically produces a democracy in which people talk at one another but never have a genuine dialogue. In such an atmosphere bad arguments pass for good arguments, and prejudice can all too easily masquerade as reason. To unmask prejudice and to secure justice, we need argument, an essential tool of civic freedom. (Nussbaum, 1997: 19)

Nussbaum notes that in the current era of increasing cultural heterogeneity the university is morally obligated more than ever to maintain, through delivery of a liberal education, its duty to cultivate 'citizens of the world'. Crucially, such citizens, she argues, can intelligently understand and confidently partake in debates about deeply entrenched societal doctrines as well as the diverse differences among various cultural groups. For Nussbaum (1997: 9), educating 'citizens of the world' is a passionately humanist project – a 'cultivating humanity'[214] – that recognizes the 'worth of human life wherever it occurs and [that we as 'cultivators'] see ourselves as bound by common human abilities and problems to people who lie at a great distance from us'. 'Citizens of the world' are de facto 'cosmopolitans' – not legal or political cosmopolitans – but rather 'moral cosmopolitans' (Friedman, 2000).

The connection between a contemporary liberal education and its supposed product of 'citizens of the world' has been most notably embraced by the American academy, but is deeply rooted in western philosophical thought; Nussbaum draws on Socrates and the Stoics (particularly Diogenes) to detail criteria for 'cultivating humanity'[215]. But what relevance does cultivating humanity – a humanist campaign for the advancement of university courses in philosophy – have to do with my students' learning in the university research lab? This is answered in my next argument.

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[213] Socratic-like inquiry additionally results in superior moral reasoning and even emotional harmony. On emotional harmony, Nussbaum (1997: 29) cites the example of the typical Roman male who felt anger at being seated low at the dinner table, stating: 'challenge the culture's obsession with these outward marks of status, and you have effectively challenged the person's basis for anger'.

[214] I like to think of 'cultivating humanity' as the *process*, while 'citizens of the world' is the *product*, of Nussbaum's (1997) project.

[215] Aside from a deeply philosophical project, Nussbaum's (1997) book is an empirical study that is abundantly peppered with illuminating anecdotal accounts of 'cultivating humanity' in various American universities.

'Inside-out learning' in the lab

First, there are striking similarities between the sort of highly reflective learning engaged by students in the humanist liberal higher education envisioned by Nussbaum, and the highly systemized nature of my students' learning in the historic university research lab, as sketched above. For my students' analysis and interpretation of *current internal research data* (and the prior theoretical planning of experiments that generated it) clearly necessitates robust intellectual reasoning[216] akin to the logical thinking at the heart of Socratic debate, and which, according to Nussbaum, is engaged by the student in the academic philosophy course. In this sense, my students in the university research lab are loosely analogous to the philosophy student – at least in terms of their approach to, and style of, learning.

Second, and not complementing the first point, I conceive that the *postmodern university* – an institution whose public sphere has been encroached by industry as a result of the *technological triumvirate* of university-industry alliances (see Chapter 6) – poses a threat to my students' *research style* concerning *current internal research data* generated in its labs. Indeed, Angell (2010, online resource[217]; my emphasis) on university-industry relations warns that the research style of industry 'focus[es] too much on targeted, *applied research*, mainly drug development, and not enough on non-targeted, *basic research* into the causes, mechanisms, and prevention of disease'. In other words, Angell fears that what I have described as the *technological triumvirate* has changed the university's scientific research style from a historic *basic* approach to a more *applied* approach (see also Giuliani & Arza, 2008). What is the problem with this?

Basic research – by virtue of its comprehensive 'cause-and-effect' approach (see McCall & Groark; online resource[218]) that attempts to understand underlying

[216] Not to suggest that regular *internal research data* does not necessitate reflective thinking. Indeed, lab meeting, at which this data is periodically presented, provokes intense intellectual thinking and discussion among peers and the lab PI as we collectively troubleshoot methodological problems, or brainstorm new theories and future research directions for the project being presented. However, my point is that *current internal research data*, due to its regularity (typically daily), regularly demands from the lab researcher a highly intellectualized reflecting-in-action (Schon, 1984) in order to steer the course, and maintain the logical integrity, of the research project at hand. For example, upon generating *current internal research data* that confirms a given hypothesis, the lab researcher, usually that same day in light of the current competitive internet-driven pace of scientific research, must brainstorm new hypotheses, and experimental ways to confirm them, in order to corroborate, or at least strengthen, the grand scientific theory.

[217] Available at: http://bostonreview.net/BR35.3/angell.php (last accessed 7/29/2012).

[218] Available at: http://www.ocd.pitt.edu/Files/Publications/Challenges%20and%20Issues%20in%20Designing%20Applied%20Research.pdf (last accessed 7/29/2012).

molecular mechanisms – demands from my students (and indeed produces) a robust intellectual breadth for its theoretical planning and practical execution[219]. *Applied research*, on the other hand, 'expands on *basic research* findings to uncover practical ways in which new knowledge can be advanced to benefit individuals and society' (online resource[220]). I therefore conceive that industry's predominant *applied research* approach – to include that imposed by industry on the university – is largely characterized by just an 'effect' approach because, although it may use, it does not always *construct basic research* knowledge[221]; *applied research* is not necessarily interested in the molecular mechanism of a drug candidate – only if that drug works or not. Accordingly, I propose that industry's *applied research* approach demands from my students less intellectual breadth[222] than university's *basic research* approach.

Lending weight to this notion, the empirical questionnaire-based research of Blumenthal *et al* (1996) reveals a striking correlation between industry-funded university labs and less influential publications, as well as lower publication rates (see also Goldfarb, 2008) – a trend that reverses when industry funding becomes a minority of total academic funding[223].

Third, and finally, and going hand-in-hand with the reconfiguration in the scientific *research style* just discussed, is the additional threat to *critically reflective thinking* on the part of my students. For earlier I showed how the frequency of generation of *current internal research data* routinely necessitates my students to systemize – largely through hypothetico-deduction – the next logical step in the research project.

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[219] 'Cause-and-effect' refers to the process of discovery by the lab researcher of a molecule that 'causes' a specific biological 'effect'. In other words, a molecular mechanistic basis for the 'effect' has been discovered, in contrast to just an 'effect' discovery that is caused by an *unknown* 'cause'. 'Cause-and-effect' research tends to be intellectually broader because there are more pieces of the scientific puzzle that fit together to reveal a more complete picture. Such research is the primary target for the academic because, if conducted robustly and the findings are significant, it tends to be accepted for publication in high-impact peer-reviewed journals such as *Nature* and *Science* – a crucial incentive for academics vying with one another for academic tenure.

[220] Available at: http://www.csrees.usda.gov/qlinks/research.html (last accessed 7/29/2012).

[221] 'Effect' research lacks equivalent intellectual breadth to 'cause-and-effect' research because the former results in fewer pieces of (namely the 'cause'), and resulting gaps in, the scientific puzzle. Industry tends to strategically adopt an 'effect' research style (with the exception of rational drug design, e.g.) because there is no greater monetary motive for industry to pursue 'cause-and-effect' research (see related discussions by Angell, 2010); indeed, it is more time-consuming and costly to industry if they did so because further inquiry would be required (i.e., to find the 'cause').

[222] Here, a crucial distinction is made: 'effect' research, despite it generally lacking the same intellectual breadth as 'cause-and-effect' research, does *not* necessarily lack *experimental breadth*; 'effect' research can still be conducted with a comprehensive and robust set of experimental methodologies containing all the critical controls.

[223] These findings are substantiated by the empirical data of Manjarrés-Henríquez *et al* (2009).

But with industry at the helm of the *postmodern university* research agenda, such critically reflective thinking could conceivably become redundant, or at least less frequent, because industry wants a greater voice with regard to the choice and execution of research projects. Here, the self-exploratory and critically reflective aspects of student-centered learning (see Rogers, 1983) – a style of learning that I advocate, and which has been empirically determined in numerous educational settings to be superior (see, e.g., O'Neil & McMahon, online resource[224], for several cited studies; Good, 2004) – are undermined because my students are reduced to an automaton[225] (see Gibbs, 1995). Indeed, Dreyer and Kouzmin (2009: 10), writing about industry steerage of the university research agenda, state that 'learning then becomes more akin to indoctrination on how to act efficiently and effectively in accordance with the prescribed set of beliefs'.

Thus, in the same way that the nature of learning in Nussbaum's (1997) notion of a liberal higher education is resoundingly democratic[226] because it grants the learner intellectual autonomy, so, too, is the nature of my students' learning concerning *current internal research data* in the historic university research lab.

But in the *postmodern university*, reconfiguration of the research lab's fundamental *research style* concerning *current internal research data* from a *basic* to a more *applied* approach, as engendered by industry, undercuts the intellectual breath of my students – and the lab as a whole. Additionally, potential encroachment by industry of my students' intellectual freedoms – including that involving their interpretation of *current internal research data*, and subsequent steering of the research project accordingly – has the potential to render my students apathetic learners, similar to that which can occur in lecture-based didactic instruction (see Shreeve, 2008). Crucially, these characteristics of the *postmodern university* appear to undemocratically undermine the robust Socratic-like reasoning necessitated by *current internal research data*.

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[224] Available at: http://www.aishe.org/readings/2005-1/oneill-mcmahon-Tues_19th_Oct_SCL.html (last accessed 7/29/2012).

[225] That is, reduced to an automaton with regard to *intellectual* breadth, but not necessarily *experimental* breadth.

[226] However, in highlighting the democratic *nature* of learning in a liberal higher education, we should not forget the deeply democratic *outcome* of such learning: i.e., a world wherein all humans, regardless of multicultural status or personal uniqueness, have a common understanding, respect, and acceptance for one another.

This argument has examined the nature of learning in the university research lab from the '*inside out*' in the sense that we probed the epistemological heart of the research and learning process. But what about those forces that affect learning in the lab from the '*outside-in*'?

'Outside-in' learning in the lab

Grimpe *et al* (2011: 1; online resource[227]) starkly remind the reader that 'industry sponsors [of university research] frequently limit disclosure of [university] research findings, methods, or materials by delaying or banning public release'; i.e., such relationships are *contractual* agreements often with strings attached.

For example, two prevalent *cultural changes* that occur in the university research lab as a consequence of the *technological triumvirate* of university-industry alliances, and a focus of this section, are: 1) a culture of research secrecy on the part of the university lab researcher (i.e., my students); and 2) delays, often (but not always) enforced by industry on a collaborating university research lab, on the submission for publication of research papers based on *internal research data*. Indeed, there is a wealth of empirical data in the academic literature that attempts to evaluate either quantitatively (with statistical analysis) or qualitatively (with questionnaires and surveys), or both, the extent of research secrecy and publication delays in the university research lab that arise from the university's – or more precisely a collaborating lab's – increased entrepreneurial ties with industry. This empirical data has been systematically reviewed by Larsen (2011). But Larsen warns that such data, and discussions arising therefrom, cannot be taken at face value, for

> the existence of a significant relationship … does not necessarily imply a causal relationship. Where there is a positive relationship between for instance a scientist's patenting activities and her scientific productivity, it is possible that neither is a consequence of the other, but that they are both instead related to other factors, such as for example personal characteristics of the scientist, to the presence of additional resources that have not been fully measured, or to the type of research problem that the scientist is working on. (Larsen, 2011: 7)

My goal with this section of the chapter, then, is to not simply recount this review of Larsen (2011); rather, I myself will draw on the academic literature in order to present

[227] Available at: http://druid8.sit.aau.dk/acc_papers/rbsry98g24d64rr632hel8u17n88.pdf (last accessed 7/29/2012).

a selection of empirical papers that, I believe, warrant discussion based on their research rigor. By this I mean that the papers appear to utilize sophisticated statistical analysis, the data generated from which reveal a compelling *correlation* between technology transfer (or other examples of university entrepreneurialism, like industry funding) and *cultural changes* in the university research lab arising as a result. In short, the data will confirm various *cultural changes* in the lab, before assessing their impact on learning in the university research lab.

My reference to the historic university *public sphere* (as explored in Chapter 6) is often, in the academic literature, correspondingly paraphrased as the 'scientific commons', or (in critical discussions about technology transfer) the '*growing privatization* of the scientific commons'[228] (see, e.g., Nelson, 2004). Historically, according to David (2004), the notion of an academic scientific commons, or 'open science' as he calls it, is a relatively new cultural phenomenon that can be traced back to the 17th century concomitant with the collapse of feudalism (see Chapter 4) and the rise of the scientific revolution. Prior to this period, science was performed in staunch secrecy in pursuit of 'nature's secrets' as exemplified by the medieval and Renaissance traditions of alchemy (David, 2004). And only just recently, in the past few decades, has the notion of open science been formally delineated by Merton's ideal 'norms' of scientific conduct (1942; see Chapter 5), in particular the norm of 'communalism' that is the expectation of the lab researcher to share with peers her scientific ideas, methods, and results; in other words, 'complete free disclosure' (Dasgupta & David, 1994: 492). Merton essentially laid the ethical groundwork for the democratic conduct and dissemination of scientific research.

In the context of the university, open science is exemplified by the 'priority-reward recognition system', also originally devised by Merton (1957). In this model, the lab researcher competes with other lab researchers with the goal to be first in contributing a significant and novel scientific finding to the scientific commons because the lab researcher is motivated by eventual professional prestige, publication of research findings, or the award of a prize (Godfrey-Smith, 2003)[229]. But even in

[228] Alternatively labeled in the academic literature as the 'anti-commons', which describes underuse by people of a limiting resource because many others in the population restrict access to it; see, for example, Heller and Eisenberg (1998).

[229] Cohen and Walsh *et al* (2007) cite additional rewards associated with 'winning' first place in the 'priority-reward recognition system'. These include the award of external sponsorship through consulting and

this system, as Hong and Walsh (2009; see also Dasgupta & David, 1994) are quick to note, academic science is built upon the contradictory motivations of 'openness' and 'secrecy': 'openness' because research findings are published, eventually, and thereby contribute to the culture of open science; 'secrecy' because research findings are invariably kept secret *until* the point of publication so that the lab researcher and her lab can be the first to claim credit for the discovery.

However, such a model of university scientific conduct *predates* the passing by the US Congress in 1980 of the Bayh-Dole Act that, recall from Chapter 5, heralded the heyday of university patenting and the consequential rise of the *technological triumvirate*. Against this backdrop, it is easy to see how the 'priority-reward recognition system' may become (or perhaps *has* become, to an extent) imbalanced as it tips more towards 'secrecy'. For it is conceivable that commercially viable discoveries are kept secret by the lab researcher pending their patent protection in order to avoid the theft, and potential ultimate monetary rewards, of such discoveries by competitors.

Turning to the empirical data, and consistent with the general findings of Campbell *et al* (2002), Hong and Walsh's (2009) data[230] reveal that secrecy[231] among experimental biologists[232] soared, with increasing scientific competition (and to a lesser extent industry funding), from 55% in the 1960s to 87% in the late 1990s[233]. Moreover, the data additionally reveal that secrecy is significantly more prevalent in experimental biology than in mathematics or physics (the other two subjects examined), which is consistent with the notion that experimental biology is a field

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speaking fees; salary increase and job security; and gaining a competitive advantage in the application for research grants, the award of which is absolutely dependent on historical reputation, particularly the quantity and quality of past research publications.

[230] Using their own mathematical modeling and independent analysis, Hong and Walsh (2009) incorporate two comparable research surveys from two different groups of lab researchers taken 30 years apart by two independent researchers. The first survey was conducted in 1966 by Hagstrom (1974) who sampled a national random sample of 1,947 academic scientists; the second survey was conducted in 1998 by Walsh *et al* (2000) who sampled a national random sample of 399 academic scientists. The former study predates the Bayh-Dole Act of 1980 – the time around the advent of the *technological triumvirate* of university-industry alliances (see Chapter 5) – whilst the latter survey postdates the Act. These studies, therefore, provide unique insights into the before and after effects of technology transfer on academic secrecy. Although the overlapping academic subjects of both surveys covered were mathematics, physics, and experimental biology, only the data of the latter subject will be considered here because it most closely aligns to the current professional context of the university molecular biology research lab.

[231] 'Secrecy' is defined by the authors, and presented to respondents, as being 'at least somewhat unwilling to talk about their ongoing research' (Hong & Walsh, 2009: 157).

[232] Here, 'experimental biologist' is professionally equivalent to 'lab researcher'.

[233] Importantly, this data complements the empirical data presented in Chapter 5 that shows a sharp spike in university patent applications, and in general technology transfer activity, after the passing of the Bayh-Dole Act.

with more patentable discoveries, especially when one thinks of pharmaceutical drugs. Interestingly, the data reveal that patenting is *not* associated with secrecy among university lab researchers, which contradicts the empirical data of Blumenthal (1997).

Similar to the findings of Hong and Walsh (2009), Grimpe *et al* (2011) reveal a significant correlation between increased industry *sponsorship* and increased secrecy and disclosure delays with regard to publications. Although the data of Grimpe *et al* (2011) regarding industry sponsorship and secrecy is derived from German universities, it does align with the data derived from American universities collated by Blumenthal *et al* (1996) to suggest that a culture of secrecy born from the *technological triumvirate* is not country-specific[234].

Whereas the data of Hong and Walsh (2009) demonstrate a culture of secrecy among lab researchers within the *same* lab (or university), the data of Blumenthal *et al* (1997) demonstrate a culture of secrecy, in the context of data and material requisitions, between lab researchers from *different* universities. Blumenthal *et al* additionally report that close to 20% of respondents claim at least one historical delay of more than 6 months on the publication of their *internal research data*. The reasons given for such publication delays are, by majority, tied to technology transfer: 46% related to pending patent applications; 26% to buy time to negotiate license agreements; and 17% to resolve legal issues related to IP (Blumenthal *et al*, 2007). Moreover, the authors reveal that delays in publication are significantly correlated with the university research lab being a recipient of industry funding – 27% of respondents receiving industry funding report publication delays, compared to 17% receiving non-industry funding – a finding that favors the notion of industry-imposed publication delays of university research lab papers containing proprietary *internal research data* (Beckelman *et al*, 2003). Lastly, 31% of respondents who engage in commercialization of their research report publication delays of more than 6 months, compared to just 11% of respondents who do not engage in commercialization. Commercialization was also significantly associated with competitiveness (and

[234] That a culture of academic secrecy is *not* specific to the US is consistent with the implementation of Bayh-Dole-like Acts in several European countries. For example, in Germany (the country of investigation in the Grimpe *et al* 2011 study, above) Siepmann (2004) reports that an amendment to the German Employed Inventor's Act essentially transferred greater commercial and economic rights of patented discoveries from the university to the lab researcher who discovered them (online resource available at: http://www.ipeg.eu/blog/wp-content/uploads/Thomas-Siepmann-THE-GLOBAL-EXPORTATION-OF-THE-U.S.-BAYHDOLE-Act.pdf - last accessed 7/29/2012).

perhaps a perceived notion of secrecy) because of those that engage in commercialization 13% denied other scientists access to biomaterials, compared to 5% who do not engage in commercialization. Indeed, the requisition of biomaterials from, and by, lab researchers is an area of investigation undertaken empirically by Walsh *et al* (2007).

The authors in this study utilized mailed questionnaires and subsequent statistical analysis in order to evaluate the impact of either patents containing, or biomaterials[235] required for research in order to reproduce, key 'knowledge inputs' necessary for the progress of research projects of university lab researchers. Walsh *et al* (2007) show that 20% of respondents' requests for tangible biomaterials were met, on the part of the lab researcher, with noncompliance. They find that such noncompliance is *not* associated with a patent on the biomaterial, but rather is tied to the donor lab researcher being engaged in commercial activity, secrecy, or inconvenience[236] – findings consistent with the data of Campbell *et al* (2002). Importantly, the authors report that noncompliance leads to the abandonment of one out of nine university lab research projects.

By contrast, the data of Walsh *et al*, from the same study (2007), demonstrates that access by the university lab researcher to intangible knowledge inputs is largely unimpeded by patents. This is despite the fact that patents legally prohibit others from using the patented knowledge (Cohen & Walsh, 2008). The authors reveal that a mere 8% of university lab researchers report that in the past two years they had conducted research using knowledge contained in an active patent; in other words, the vast majority of university lab researchers are oblivious to, or simply disregard[237], the possibility that their knowledge inputs may be covered by an active patent (Walsh *et al*, 2007). The study finds that for those lab researchers cognizant of, and who subsequently submit a request to obtain, a knowledge input contained in an active patent is a *minimal* impediment to the requester's research: *none* of the random respondents aborted their research project; less than 1% experienced delays or

[235] 'Biomaterials' are defined by the authors as *tangible* materials required for research inputs such as a plasmid, cell line, tissue, organism, etc. (Walsh *et al*, 2007).

[236] Much of the source of this inconvenience comes from the requirement by the donor university lab researcher to draft a Material Transfer Agreement (MTA), which is the necessary formal paperwork required to fulfill such requests.

[237] Reasons for this ignorance on the part of the university lab researcher are suggested by the authors and include, for example: habits originating from pre-patent times; competitive career advancement; and the historically low incidence of lawsuits centered on patent infringement.

modified their research; and the vast majority incurred no cost to access knowledge contained in a patent (Walsh *et al*, 2007).

In light of all this empirical data, we now assess the impact of *cultural changes* in the university research lab on my students' learning therein. In order to do so, I apply the same economic framework and nomenclature (Gazier & Touffut, 2006; Kaul & Mendoza, 2003) that I utilized in Chapter 3 to determine the 'economic good status' of knowledge in various contexts:

First, from previous chapters we learned that technology transfer – a complex and collective product of key *hard*, *soft*, and *control* technologies (Chapters 2, 3, 4) – opened the doors of the university to additional entrepreneurial ties with industry, and the *technological triumvirate* of university-industry alliances was born (Chapter 5). Upon review of the empirical data presented in this chapter, we now see that the *technological triumvirate* is apparently responsible for a heightened culture of secrecy among lab researchers (i.e., my students) in the *postmodern university*[238] (a concept built in Chapter 6).

For the data of Hong and Walsh (2009) – a longitudinal study examining before and after effects – shows that heightened secrecy strikingly correlates with the emergence, around the 1980s, of the *technological triumvirate*[239]. Consistently, the data of Grimpe *et al* (2011; and Blumenthal *et al*, 1996) correlates increased secrecy with increased university sponsorship from industry[240]; industry sponsorship, like technology transfer, is a key manifestation of the *technological triumvirate* (Chapter 5). Increased industry sponsorship of the university research lab additionally correlates with increased publication delays, according to the data of Blumenthal *et al* (1997). And lastly, the data of Walsh *et al* (2007; and Campbell *et al*, 2002) shows that such secrecy may provoke on the part of the university lab researcher actions of noncompliance for requested tangible biomaterials from other lab researchers.

[238] 'Postmodern' is *my* designator (not the authors) for the contemporary universities examined in these studies; see Chapter 6.

[239] The emergence of the *technological triumvirate* is coincident with the passage in 1980 of the US Bayh-Dole Act; see Chapter 5.

[240] The data of Blumenthal *et al* (1997) demonstrates that this heightened culture of secrecy is not just contained within the *same* university, but rather reverberates among *many* universities – suggesting that secrecy is an industry-wide phenomenon.

Second, as a probable product of the *technological triumvirate*, heightened secrecy would appear to confer among my students a degree of economic *rivalry* to the *internal research data* (hereafter 'knowledge') being kept secret. This is so, because consumption[241] by one of my students of a given secret knowledge precludes, by virtue of the fact that it is secret and therefore non-sharable, simultaneous consumption by *other* university lab researchers of the very same knowledge[242]. Moreover, because no one purchased this knowledge – my student *generated* it – then I conceive that this knowledge to this student is economically *nonexcludable*. However, I conceive that the knowledge becomes *excludable* to *others* should the student patent it, and legitimate use of which is only available upon payment of a license fee. However, this scenario is contrary to the data reported by Walsh *et al* (2007) where illegitimate use (knowingly or unknowingly) of knowledge protected by a patent is not uncommon among university lab researchers.

Meanwhile, in the case of noncompliance for requested biomaterials, I suggest that this may create a case of economic *rivalry* whereby the requestor *knows* a certain knowledge, but requires a critical biomaterial from another research lab in order to conduct an experiment(s) that generates *tangible* confirmation of the knowledge (such as a picture of a protein gel) for a scientific paper. In this instance, the knowledge – more precisely, tangible confirmation of it – is *rivalrous* to the broader scientific community insofar as noncompliance for the critical requested biomaterial is ongoing.

Third, and finally, as a probable product of the *technological triumvirate*, heightened publication delays would (like heightened secrecy) appear to confer among my students a degree of economic *rivalry* on the knowledge being delayed. This is the case because consumption by the author of a given publication-pending paper precludes simultaneous consumption by *other* university lab researchers of the

[241] 'Consumption' in this context refers to use by the lab researcher of the knowledge to steer her immediate experimental direction. You will recall from earlier discussions that a given knowledge comprising either a single piece or set of data can entirely confirm or refute an experimental hypothesis; knowledge acquisition, no matter how big or small, is key to contributing to the greater scientific picture – not just for the university lab researcher who generated it – but for *all* university lab researchers working in the same research field.

[242] Remember we are talking here about a *heightened* degree of secrecy – as opposed to the regular, and expected, degree of secrecy common among many university lab researchers *outside* the context of the *technological triumvirate* (see Merton, 1957).

very same knowledge contained in the paper[243]. However, a crucial distinction between these two causes of *rivalry* must be made:

In the case of secrecy, the *length* of the *rivalry* is at the arbitrary will of the university lab researcher maintaining rivalry of the knowledge via secrecy.

In the case of publication delays, the length of the rivalry is presumably at the will of the industry sponsor imposing the delay (and in turn *rivalry*), but such delays appear to be of a more predictable length of time (6 months or so) than that for secrecy. Indeed, the fact that the university lab researcher has packaged her data as part of a scientific paper is testament to her eagerness to get the paper published, which in turn, in the context of online bibliographic databases, would ultimately lift the *rivalry* conferred to the knowledge[244].

Therefore, with secrecy we see greater embodiment in my students of 'manipulable man' – a neoliberal constructed character that, recall from Chapter 4, is a more aggressive market player than the *Homo economicus* character of classical liberalism (Ollsen *et al*, 2004; Read, 2009). For secrecy – more precisely *heightened* secrecy – has the opposite effect of publication: that is, to *proactively* stall dissemination of knowledge for potentially prolonged periods of time presumably for my students' personal competitive advantage.

Thus, certain *internal research data* generated in the university lab against the backdrop of the *technological triumvirate* is both more *rivalrous* and, for the most part, *nonexcludable* – dual economic designators that label such knowledge a 'common good'[245] (Gazier & Touffut, 2006; Kaul & Mendoza, 2003). Moreover, such heightened rivalry is primarily mediated by tangible and intangible forms of secrecy on the part of my students, as well as publication delays imposed by industry; i.e., a heightened culture of commercialization triggered by the *technological triumvirate*. No mention is made in my argument about the patenting of *internal research data* because, paradoxically, it apparently does *not* impede subsequent

[243] Again, because no one purchased this knowledge then the knowledge, to the university lab researcher who generated it, is economically *nonexcludable*.

[244] One might argue that, upon publication, the paper comes under the control of a publishing company, and access to it is only possible by purchasing the article (up to the point of purchase, then, the paper is technically *excludable*). However, recall from discussions in Chapter 1 that access by the university lab researcher to most scientific papers published in scholarly journals is free – i.e., *nonexcludable* – owing to free institutional access to them.

[245] More precisely, I should say '*heightened* common good' to reflect the fact that university lab knowledge already is a common good, just less so outside the context of the *technological triumvirate*.

access to, use, or duplication of, this knowledge by others (Walsh *et al*. 2007; also Straus, 2002)[246]. Walsh *et al* (2007) conclude their study by actually downplaying the notion of any potential adverse impacts of patenting on the downstream use of such knowledge by arguing that

> debates … on the effects on academic research of the patenting of upstream biomedical discoveries may not be addressing the most pressing policy question. Research may … be more effectively supported by addressing the transaction costs, competitive pressures and commercial interests that are impeding the sharing of data and material research inputs. (Walsh *et al*, 2007: 1201)

So, surprisingly, it is not so much technology transfer per se that is the cause of heightened knowledge *rivalry*, but rather the heightened culture of commercialization – such as secrecy and publication delays – arising therefrom, as well as the broader *technological triumvirate* that extends to industry sponsorship.

The finding that my students' knowledge is a 'common good' in this context has obvious profound implications for learning in the university research lab; namely, that less knowledge is shared within the research community. Yet an equally profound and not-so-obvious implication comes from considering *external research data*. The reader will recall from Chapter 1 that university *internal research data* ultimately becomes, following the peer-review process, *external research data* in the form of papers published in scholarly journals; after all, the ultimate (perhaps not short-term) goal of my students is professional recognition and reward via publishing (Merton, 1957). These journals are available to a *global* scientific audience in centralized online bibliographic databases like PubMed.

But when *internal research data* has been subject to a heightened state of rivalry, the *external research data* pool is partially and temporarily starved pending actual publication (or presentation at a conference) of the rivalrous *internal research data* that will ultimately contribute to it. Such collective rivalrous knowledge could conceivably impede the pace of learning among my students because this knowledge

[246] Note that an empirical paper by Murray and Stern (2007) contradicts these findings of Walsh *et al* (2007). However, the study of Murray and Stern exclusively concerns university 'patent-paper' outcomes – the process by which academic scientific discoveries are simultaneously patented and published. But this data, I caution, cannot be compared to that of Walsh *et al* because the latter study does *not* take into account patent-paper outcomes, and so comparing the two studies is like comparing apples and oranges. Moreover, Murray and Stern find a mere *modest* anti-commons threat within this highly specialized and narrow publishing outcome with just a single scholarly journal; indeed, the authors warn that 'evidence for the anti-commons effect captures only *one aspect* of the impact of IP' (Murray & Stern, 2007: 684; my emphasis). Underscoring potential shortcomings with their study, the authors conclude that '[we] are cautious in the interpretation of [our] findings' (Murray & Stern, 2007: 683), and then proceed to list several caveats with their methodological approach and the data arising therefrom.

may be the critical missing piece of the jig-saw puzzle of the scientific hypotheses of other researchers. Then again, not having the critical piece of the jig-saw puzzle may make my students even more motivated to find it, thereby increasing productivity in the lab – and, in turn, learning through the generation of *current internal research data*.

And so with these arguments we see how the expansive and potent forces of our *technologizing world* trickle all the way down into the university research lab where they can profoundly impact my students' learning concerning *internal research data*. In the next, and last, chapter I collectively review the major arguments of the dissertation before proposing solutions for the various problems highlighted in this chapter concerning my students' learning in the *postmodern university* research lab.

8

Back to the future

Borrowing from the popular 1985 time-travel film of the same name, the oxymoronic title of this last chapter of the dissertation is intended to convey the chapter's twofold purpose. First, we 'travel back in time' to the beginning of the dissertation in order to summarize its central arguments, and from which we extract and deconstruct a central theme of the dissertation, the purpose of which will become apparent later. And second, we 'travel into the future' where we explore possible realms of freedom from the undemocratic constraints to learning encountered in the *postmodern university* research lab.

Hard, soft, control: reflections on the 'technological triumvirate'

The dissertation consists of two phases: **phase one** delineated the concept of the *technological triumvirate* of university-industry alliances, and **phase two** explored the actual impact of the *technological triumvirate* on the shaping of the contemporary university and, in the context of this institution, learning in its research labs. A more detailed summary of the dissertation follows.

First, having outlined in Chapter 1 my professional practice and central research problem, Chapter 2 laid the conceptual backbone for the dissertation. Here, I delineated three types of technology common to contemporary society: *hard*, *soft*, and *control*; i.e., my *technology concepts framework*.

Chapter 3 showed that certain *hard* ICTs were instrumental in the late 20th century transition of the university to a knowledge-based economy because these technologies collectively provide an increased capacity to *store* and *manipulate* knowledge[247]. Moreover, the cognate *soft* technology of each *hard* ICT examined provides an increased capacity to *disseminate* knowledge[248]. Such ICT-mediated *heightened knowledge conveyance* cultivated the necessary conditions for a knowledge economy by fuelling the scarcity-defying nature of knowledge, thereby rendering it (within the context of IP law) a lucrative global commodity. In sum, *hard* and *soft* technologies that gave rise to a knowledge economy set the *technological* stage for the *technological triumvirate*.

Chapter 4 argued that neoliberalism is a paradoxical *control* technology. For while this political doctrine appears to represent a mere revival of classical liberalism, it is actually a *control* technology that undemocratically *controls*[249] the individual in a state-fabricated free-market economy that instrumentally reduces the individual (including the lab researcher) to a 'standing reserve'[250]. In essence, the individual and institutions are controlled by the neoliberal state as a *means* ('standing reserve') for the neoliberal state *end* of optimal market efficiency in a competitive global capitalist

[247] Increased knowledge *storage* and *manipulation*, recall, constitute the first two criteria of my threefold *heightened knowledge conveyance framework* – a prerequisite for labeling a given technology an 'ICT'.

[248] Increased knowledge *dissemination*, recall, is the third criterion of my threefold *heightened knowledge conveyance framework*.

[249] Recall that neoliberalism is a *control* technology due to its dual *unconscious* and *undemocratic* dimensions that are heightened relative to classical liberalism.

[250] This is a concept of Heidegger (1977); for a more descriptive definition refer to Chapters 2 and 4.

economy. In sum, the *control* technology of neoliberalism set the *political* stage for the *technological triumvirate*.

Chapter 5 demonstrated that exploitation by the university of a knowledge economy through sale of its *internal research data* to industry in a neoliberal era of university entrepreneurialism has become a dominant trend in the American higher education system. The Bayh-Dole Act was a crucial neoliberal policy that catalyzed the university's historical engagement in *technology transfer*; this opened the doors of the university to additional entrepreneurial ventures with industry, and the *technological triumvirate* of university-industry alliances was born.

Hence, the university sale of its select *internal research data* to industry may be conceived as a product of our *technologizing world* – a finding that concluded the **first phase** of the dissertation.

Second, we switched gears in Chapter 6, and in doing so segued to the **second phase** of the dissertation; i.e., a closer examination of the actual university in the context of our *technologizing world*, and (in Chapter 7) learning dynamics in the lab therein. Chapter 6 showed that the *technological triumvirate* – as exemplified by the archetypal university-industry alliance of *technology transfer* – caused industry's encroachment upon the university's historic public sphere[251].

I argued that industry's encroachment upon the university's historic public sphere is a scenario that reflects Lyotard's *performativity* thesis of knowledge legitimation in contemporary capitalist society. This argument was based on industry's desire to steer the university research agenda *away* from the research lab's academic research interests, and *towards* industry's own commercial motivations; under these conditions, the university became *postmodern*[252].

Further, I argued that my notion of the *postmodern university* does not include theoretical threads of the *corporate university*. For in the former, industry represented an external force that *proactively sought* the university in order to appropriate its intellectual resources entirely for its own commercial ends. In contrast, the *corporate university* was (and is) an institution that merely adapted to the inevitable changing

[251] I further argued that because technology transfer opened the university doors to other entrepreneurial relationships with industry, technology transfer may additionally be conceived as the entrepreneurial seed from which the notion of the *corporate university* grew.

[252] Because such knowledge is not absolutely true to the research lab's original academic agenda, it represents the *minimizing input*, while in the same scenario, industry's commercial motivations represent the *maximizing output* of Lyotard's performativity equation.

landscape of contemporary society – neoliberalism, the advent of postmodernity, etc. – by implementing its own necessary restructuring.

Hence, in the context of the *technological triumvirate*, the contemporary university revealed its face in Chapter 6 as a decidedly *postmodern* one.

Third, and finally, Chapter 7 argued that the *technological triumvirate* could cause a fundamental switch in the *postmodern university's* research style from a *basic* to a more *applied* approach. The latter of the two, I argued, is a less robust learning experience because it demands a narrower *intellectual breadth* on the part of the university lab researcher. Relatedly, increased steerage by industry of the university research lab's theoretical and practical research direction could erode the critically reflective capacity of the researcher.

Chapter 7 additionally revealed that the *technological triumvirate* is responsible for three prominent *cultural changes* in the *postmodern university* research lab that fundamentally reconfigure the 'economic good status' of knowledge generated therein:

1) *heightened secrecy*, I showed, confers among university lab researchers economic *rivalry* to the *internal research data* being kept secret. And because no one purchased the knowledge, it is additionally *nonexcludable*. Paradoxically, the patenting of *internal research data* apparently does *not* impede subsequent access to, or use of, this knowledge by others.

2) *noncompliance with requested biomaterials* creates a case of economic *rivalry* whereby *tangible* proof of a given known knowledge is *rivalrous* to the broader scientific community insofar as noncompliance for a given critical requested biomaterial – essential for generating tangible confirmation of the knowledge – is ongoing. And

3) *Publication delays*, like heightened secrecy, confer among university lab researchers a degree of economic *rivalry* and *nonexcludability* on the knowledge being delayed. Whereas with heightened secrecy the *length* of the *rivalry* is at the arbitrary will of the university lab researcher, with publication delays the length of the rivalry is presumably at the will of the industry sponsor imposing the delay.

Hence, certain *internal research data* generated in the *postmodern university* research lab is both more *rivalrous* and (for the most part) *nonexcludable*; i.e., in economic terms, a *heightened* 'common good'.

Thus, we inhabit a *technologizing world* in which the synergistic effects of various technologies on education – namely, the rise of the *postmodern university* and profound changes to learning in its research labs – are pervasive and profound. Now that the central arguments of the dissertation have been summarized, we turn to discuss their impact on my professional role as an educator in the *postmodern university* research lab.

The contradictory convergence of past and present

At the heart of most (if not all) of the issues reported in the dissertation that pertain to learning in the *postmodern university* research lab (see Chapter 7) is a deeply *contradictory convergence*. It is between the lab's historic and customary culture of free and 'open' science – i.e., the remnants of research under classical liberalism – and the more controlled, or 'closed'[253], research conditions imposed by industry that arise under neoliberalism[254]. Indeed, this contradiction is echoed by Amsler (2010: 22) who 'seek[s] to work within the contradictions which emerge between the principles of critical pedagogy [exemplified by learning in the *historic* university research lab under classical liberalism] and the existing political economy [neoliberalism] of organised higher education'. So what can I as a lab educator, and 'lab researchers' collectively, do to reconcile the two competing forces of the willingness and freedom to research and publish what one wants (i.e., open science) versus the research and publication constraints levied by industry, and the various cultural changes that ensue (i.e., closed science)? In order to answer this, we must extract and dissect from the preceding summary a central theme of the dissertation in order to get to the root cause of the contradiction:

[253] 'Closed' science essentially comprises two phenomena, as outlined in the preceding summary of the dissertation: 1) the switch from a *basic* to an *applied* research approach (and the related erosion of the lab researcher's critically reflective capacity); and 2) key *cultural changes* in the *postmodern university* research lab.

[254] *Contradictory convergence* is premised on the notion of the *desire* of the *postmodern university* lab researcher to conduct open and free scientific research. Therefore, one would expect it to *not* be a *contradictory convergence* in the case of the *postmodern university* lab researcher who is *willingly* engaged in a controlled research collaboration (i.e., one that exemplifies closed science) with industry.

First, the culminating theme of the **first phase** of the dissertation (Chapters 2 through 5) is the *technological triumvirate* of university-industry alliances. Here, the university operating in a neoliberal (i.e., a *control* technology) climate of pervasive privatization exploits a knowledge economy (i.e., *hard* and *soft* technologies) by selling select *internal research data* to industry; other university entrepreneurial ventures blossom.

Second, the **second phase** of the dissertation (Chapters 6 and 7) takes the concept of the *technological triumvirate* and shows how it is a key causative force in: 1) the formation of the *postmodern university*; and 2) fundamental changes in the nature of learning (pertaining to the fundamental *research style* and certain *cultural changes*) *within* the *postmodern university* research lab.

Third, and finally, the products of the *technological triumvirate* that are the *postmodern university* and concurrent changes to learning in its research labs arise as a result of industry's alignment of the university's research agenda with its own; i.e., the emergence of closed science.

Hence, the *contradictory convergence* of open versus closed science in the *postmodern university* research lab is ultimately caused by the complex collective components of the *technological triumvirate*. Moreover, these components are unequivocally capitalist in nature. For the ultimate pursuit of the *controllers* of each component – a knowledge economy (born from *hard* and *soft* technologies), neoliberalism (a *control* technology), the university (a quasi-corporate institution), and industry (a corporation) – is, respectively: profit (or at least financial or commercial gain) from the sale of knowledge; the capitalization of society[255]; the corporatization of higher education (and profit maximization in the case of the for-profit university); and perpetual profit maximization. Crucially, these are all core qualities or goals of capitalism[256]. Since the root cause of the *contradictory convergence* is ultimately attributable to capitalism via the *technological triumvirate*, it would make sense that the natural approach to tackle it is an anti-capitalist one[257].

[255] For neoliberalism as an obvious embodiment, pervasive implementer, and driver, of capitalism in contemporary society, see in-depth discussion in Chapter 4, especially concluding remarks towards the end of this chapter.

[256] Note that each component of the *technological triumvirate* was inherently capitalist *prior* to the formation of the *technological triumvirate*. That is, except for the university, until a knowledge economy and neoliberalism caused evolution of the historic university into a quasi-corporate – and in turn capitalist – institution.

[257] 'Approach' is premised on practical *action*, which is distinct from just 'critique', with the former often being prompted by the latter.

In asking what it means to be 'anti-capitalist', Slaughter (2005: 189) writes that the foundation for an answer – but 'not of course the answer itself' – can be found in the writings of Marx and Engels. Indeed, the historical foundation for an anti-capitalist approach was famously outlined by Marx (and Engels [1848] 2008)[258] who, in essence, argued that industrial capitalist societies are characterized by an ongoing class struggle[259]. In this struggle, ruling capitalists ('bourgeoisie') own the bulk of the means of production, and reap the surplus value through exploitation of the working class ('proletariat') (Duncan, 1989); i.e., a society characterized by the inevitable contradiction 'between the social relations of production and the forces of production' (Young, 1976: 196). But times have changed since Marx, and so too have many facets of capitalism.

For example, Drucker (1993) argues that *contemporary* capitalism, or 'post-capitalism' as he calls it, is a relatively egalitarian social system because it is characterized by 'knowledge workers' who, contrary to the traditional perceived capitalist mode of production, own both the 'means of production' through their pension funds, and the 'tools of production' through transferability of their specialist knowledge skills. Moreover, Butler (online resource[260]) believes that the more serious woes of capitalism are not the result of the presumed inherent dysfunctions of a free market economy, but are rather the result of human doing – or lack thereof:

> the [ensuing global financial] crisis was not caused by capitalism's being fatally flawed. It was caused by politicians forcing the banks to give out bad loans, monetary authorities flooding the West with cheap credit and regulators being asleep at the wheel.

Therefore, notwithstanding legitimate social and economic inequality (Webber, 2012)[261], *contemporary* capitalism, or more precisely certain facets of it, need not always arouse an 'anti-capitalist approach' to it – especially of the *radical* (or 'totalitarian'; Caffentzis, 2011) sort proposed by Marx (2008). So is anti-capitalist the

[258] Contrary to popular belief, Caffentzis (2011) reports that anti-capitalist movements were present *prior* to Marx, citing academic literature dedicated to the analysis of such movements.

[259] Marx's (2008) proposed approach – i.e. practical *action* – is a revolutionary one called 'dictatorship of the proletariat'. Here, collapse of the class struggle is accomplished upon violent overthrow by the proletariat of the capitalist order with a consequent rise of a classless communist society comprising collective social ownership and control of the means of production (Duncan, 1989).

[260] Available at: http://www.policynetwork.net/development/media/blame-bad-rules-not-bad-capitalism (last accessed 7/29/2012).

[261] For Webber (2012), it is not capitalism per se that is the problem, but rather the *way in which it is practiced*, arguing that the two other popular historical political doctrines of communism and socialism are more fatally flawed and corrupt than capitalism.

right approach to reconcile the *contradictory convergence*? To answer this, we must evaluate each causal capitalist component of the *technological triumvirate* – i.e., a knowledge economy, neoliberalism, the university, and industry – as a *legitimate* target of an anti-capitalist approach:

First, the dissertation has shown the numerous positive ways in which a knowledge economy – *an embodiment of capitalism* – has revolutionized learning in the university research lab, especially in the context of *heightened knowledge conveyance* (see Chapter 3). A knowledge economy, then, largely because of its monumental contributions to learning in, as well as its critical contributions to the economic infrastructure of, contemporary society, is not necessarily an appropriate target of an anti-capitalist approach. But another reason for excluding a knowledge economy as a viable target follows.

Second, neoliberalism is an obvious target of an anti-capitalist approach because it is a *control* technology that was an instrumental capitalist force in fashioning the university into a postmodern institution. However, the fact that neoliberalism is such a distant cause of the *contradictory convergence* precludes it from being a legitimate target. In other words, neoliberalism – as with a knowledge economy – is an *upstream* causal capitalist component of the *technological triumvirate*, which in turn makes it a more distant cause of the *contradictory convergence* than, say, the university, which is a more *downstream* or immediate cause of the *contradictory convergence*. For this reason, an anti-capitalist approach targeting neoliberalism seems unviable[262].

Third, in the *technological triumvirate* chain-of-causality, the university itself is an *immediate* cause of the *contradictory convergence* of open versus closed science

[262] And even if neoliberalism *were* a target of an anti-capitalist approach, what shape would it take? This is difficult to define given that neoliberalism is a political doctrine, the effects of which are ideologically omnipresent; many *downstream* effects of neoliberal policy are felt in the university (e.g., closed science in the context of the *contradictory convergence*) inasmuch as they are felt outside it (e.g., personal financial debt from purchasing privatized healthcare). Therefore, to truly *target* neoliberalism is to target the source – that being the neoliberal political party in power – which (in anti-capitalist fashion or not) amounts to otherthrow, or at least social or political challenge, of the party. For to target the *downstream* effects of neoliberalism does not target neoliberalism per se – but rather an indirect downstream cause of it. That said, to truly target the source of neoliberalism by myself, or even a mass movement of lab educators, is not only preposterous, but unrealistic; indeed, Marlowe (2000: 1046) reminds us that 'the remedy of "overthrowing" [for example] a state government seems not only implausible today, but also unrealistic and impractical'.

in its research labs precisely because it is host to the problem; i.e., it opens its doors to industry. But I previously argued that this is through no fault of its own; the university is merely adapting to the political and economic landscape of neoliberalism through, for example, its utilization of a knowledge economy by engaging in technology transfer. This market survival mechanism by the university, I believe, renders it too an implausible target of an anti-capitalist approach.

Fourth, and finally, industry – the second *immediate* cause of the *contradictory convergence* – is, unlike the university, a more proactive player in the *technological triumvirate*. For the reader will recall from Chapter 6 that industry is an exogenous force that *proactively seeks* the university in order to appropriate its intellectual resources for its own commercial leverage, making industry the prime candidate for an anti-capitalist approach. But two points seriously undermine, and as a result I believe exempt, industry as a plausible target:

1) to target industry is to target the university (which I have already made exempt, above), given the contemporary university's exquisite dependence on the capitalist activities of industry in the context of the *technological triumvirate*; the university is a de facto supporter of industry, and more broadly capitalism. And,
2) with reference to not just my analysis of industry, but to *all* causal capitalist components of the *technological triumvirate*, my *acceptance* of capitalism as a prominent political, economic, and cultural reality of contemporary society calls into question my anti-capitalist approach as possibly hypocritical. And despite the fact that the ongoing global financial crisis may mark an end to the way in which capitalism is *managed*, it does not mark an end to capitalism *per se*[263].

Thus, none of the causal capitalist components of the *technological triumvirate* present viable targets of an anti-capitalist solution to the problems I have described and analyzed; however, this does *not* preclude them from anti-capitalist

[263] This is evident in President Barack Obama's policies that perpetuate consumerist, and a plethora of other forms of, capitalism that were largely inherited, together with the financial crisis, from former President George W. Bush's administration. Crucially, under the former, capitalism is subject to greater regulation through third way policy, whereas under the latter, capitalism was so unregulated through neoliberal policy that it precipitated the financial crisis (see Bresser-Pereira, 2010); in both cases, capitalism is very much present – but managed differently. (For the third way and neoliberalism as embodiments of capitalism, see Chapter 4.)

critique[264]. In recognizing industry as an *immediate* and proactive cause of closed science, I instead propose a *resistance approach* that targets industry in the specific context of the *contradictory convergence* of open versus closed science[265]. The practicalities of my *resistance approach* I now outline.

The 'technological triumvirate': freedoms and possibilities

Rikowski (2004) draws on Marx to outline an anti-capitalist 'education for the future' (this is one possible example of a 'critical pedagogy'[266]; see Amsler, 2010)[267]. Rikowski (2004) emphasizes that his education for the future does not simply have a clear start and finish with educational ideals at the end. Rather, it is a process in continual flux with 'no fixed or end state' – a 'kind of becoming' (Rikowski, 2004: 566) – consistent with Marx and Engel's (1976: 57; cited in Rikowski, 2004) notion of communism as a 'state of affairs'. Being a 'state of affairs' suggests that communism is a preexisting, albeit repressed, social condition within capitalist society that needs awakening – or 'objective maturation' (Slaughter, 2005: 191) – through a 'transitional epoch', by the working class (Rikowski, 2004). According to Rikowski,

[264] A common and recurring anti-capitalist critique of a knowledge economy, for example, is the stark disparity in access to digital technology, particularly in developing countries, which has given rise to the so-called 'digital divide; see, for example, Gleave (2002).

[265] My *resistance approach* is more nuanced than an anti-capitalist approach because, following Marx and many scholars, the former does not carry the same connotative radicalism of the latter. For example, Marxist scholar David Harvey (2012: 25) radically states that 'the ultimate aim of anti-capitalist struggle is, quite simply, the abolition of that class relation'. What is the problem with radicalism? First, radicalism is a reaction or a solution to some radical circumstance or scenario. But as I argued above, capitalism in and out of the current professional context does not, for the most part (and in light of the necessary preservation of industry's role in the *postmodern university*), create a scenario sufficiently radical to warrant a radical (anti-capitalist or other) reaction. Second, radicalism, more so than conservatism, in the process of attaining the best outcomes for humanity, can, ironically, create the worst outcomes for humanity (e.g., radical resistance to industry's presence in the university could result in less industry sponsorship of university research, which in turn would impede research). In short, the ultimate goal of my *resistance approach* is positive change with minimal disruption to research and learning in the research lab.

[266] Critical pedagogy is closely associated with the tool of 'consciousness-raising', which may be defined (rather simplistically so) as 'increased awareness about the causes, consequences, and cures for a particular problem behavior' (Prochaska *et al* 2008: 101). Consciousness-raising is rooted in radical feminism of the 1960s (Sarachild, 1978; Wang & Burris, 1994), but nowadays has become deeply embedded in (but is by no means exclusive to; see, e.g., Parker & Fukuyama, 2006) feminist research methodology (Ball, 1992). Consciousness-raising has been taken up most notably by Brazilian pedagogue Paulo Freire (see La Belle, 1987) whose 'conscientization' process describes how the learner becomes cognizant of, and undertakes subsequent emancipatory action in response to, various societal oppressions (Yep, 1998).

[267] Building on Marx, Rikowski's (2005) anti-capitalist approach underscores the belief that the paramount ingredient for the production of capital – i.e., labor power, which is the commodity that laborers own and sell to capitalists for a wage – is, paradoxically, capital's 'weakest link' because it rests entirely on the *will* of the laborer. As such, labor power (and, in turn, capital production) is precariously vulnerable to labor disputes – or more dramatically, anti-capitalist approaches – on the part of the laborer(s).

and in the context of education, this awakening is attainable if schools incorporate three 'moments'[268] in order to be truly anti-capitalist:

First, the educator must engage in a comprehensive critique of all facets of capitalist society and education (Rikowski, 2004: 567)[269].

Second, critique alone is insufficient; one must strive to 'meet human needs and education' (Rikowski, 2004: 568)[270].

And third, one must work towards 'realms of freedom' because an education of the future incorporating just 'critique' and 'addressing human needs' may, according to Rikowski, appear 'negative' and 'self-sacrificial'. Realms of freedom, which is associated with transformative social action, is about resisting the institutionalized processes of capitalism and capitalist schooling. And it is precisely this third 'moment' of Rikowski that inspired me to explore the realms of freedom attainable in my own profession through the practical engagement of my *resistance approach*:

First, and foremost, I am committed to preserving a *basic* research approach as the primary research style in the university research lab. I previously showed that a *basic* research approach – i.e., the cultural norm of the historic university – is more democratic than industry's preferred *applied* research approach because the former not only empowers the lab researcher with greater intellectual autonomy, but it additionally demands, and garners, greater intellectual breadth on the part of the university lab researcher. How does this commitment play out in reality?

My *resistance approach* resists the capitalist motives of industry in the university research lab, which in this instance is industry's preference of an *applied* research approach as a means to streamline and economize the research process in order to expedite drug discovery, development and, ultimately, commercialization. But because *applied* research actually expedites the discovery of novel drug candidates due to its highly targeted approach, perhaps I should propose an

[268] Rikowski's (2004) three 'moments' loosely follow the reflective cycles of 'research', 'experiential learning', and 'action', in the context of action research (Boog, 2003: 432).

[269] This includes a critique of all forms of social inequality – including 'capitalist patriarchy' (see Ambrose, 2012) – because these are ultimately and inextricably tied to capital accumulation and value production (Rikowski, 2004, 2005).

[270] For Rikowski, critique must be ultimately motivated by 'human needs' – not just those of the student, but by the community at large – as the desired end goal of critique.

enrichment of, rather than an outright resistance to, industry's *applied* research approach.

As a university lab educator I am committed to encouraging my students to frequent the academic literature in order to seek relevant published papers containing *basic* research that originally informed the *applied* research which they are conducting. After all, we learned in Chapter 7 that *basic* research is the theoretical basis for *applied* research. Reading the academic literature gives one a richer understanding – i.e., a broader intellectual breadth – of the *applied* research they are working on. And in doing so, it carries the potential to spawn new avenues of research that may ultimately *enrich* the long-term goals of their *applied* research in a manner wholly consistent with a culture of open science. This is especially true if my students keep abreast of new publications in their research field that appear in real-time in the context of *online* bibliographic databases like PubMed (see Chapter 1).

Second, I am committed to cultivating the critically reflective capacity of my students. I noted in Chapter 1 that as a lab educator I am an educational 'observer' (as much as an educational 'doer') in the sense that I merely *guide* my students into an adult-centered learning experience – hence the occasional reference of my students as 'my peers'. This is my preferred pedagogical approach because it independently forces my students to actively deconstruct the theoretical meaning of their own *current internal research data* that, in turn, assists in their next logical steering of the research project. But I earlier warned that the researcher's critically reflective capacity is in danger of becoming redundant if industry controls the research path and process. So how do I execute this commitment?

Here, my *resistance approach* resists the capitalist way in which industry objectifies the lab researcher by tightly controlling both the methodological execution and theoretical direction of the research project in a manner that most efficiently meets industry's market desires.

As a lab educator I propose that preservation of a *basic* research approach is, in the tradition of true open science, key to cultivating the lab researcher's critically reflective capacity. For the intellectual autonomy created by the former is in fact an expression of the latter; they go hand-in-hand. But the lab educator can do more to cultivate the lab researcher's critically reflective capacity. For example, I will encourage more frequent attendance at lab meetings as a way for my students to fully

grasp the meaning of, as well as to gain from their peers fresh and critical perspectives on, their research (the logical integrity of which can all too easy get lost in the context of fast paced university-industry research collaborations). Similarly, establishment of a 'journal club' (see Esisi, 2007; online resource[271]) – an informal periodic group discussion wherein researchers critically review one chosen peer-reviewed publication – provides a means to sharpen the student's critically reflective capacity through the systematic scientific analysis, review, and critique of *external research data*.

Third, I am committed to discouraging among my students a culture of heightened secrecy within my lab, aside from the unavoidable degree of secrecy associated with, and expected from, the competitive lab researcher. A culture of open science, on the other hand, is an open-minded team effort (as opposed to a close-minded personal effort) whereby students *collectively* brainstorm, troubleshoot, and finesse one another's research projects. Such team effort expedites learning and, in turn, the progress of scientific endeavor because many minds are better than one. How do I enact this commitment?

Because heightened secrecy is a phenomenon that affects the university lab researcher, my *resistance approach* in this instance involves my commitment to resist the capitalist tendencies of the lab researcher – as against those of industry. However, it may not be literal '*capitalist* tendencies' on the part of the university lab researcher that are the issue because it is unlikely to be profit (i.e., a primary monetary motive of capitalism) that is motivating the lab researcher to engage in heightened secrecy. Instead, the lab researcher's temptation to heightened secrecy would presumably be ultimately motivated by the desire to be the sole recipient of some form of monetary reward like patent licensing fees or consultation fees that, nevertheless, were conceived by, and occur in, the very capitalist context of the *technological triumvirate*.

As a lab educator my *resistance approach* in this instance involves my commitment to cultivating and strengthening among my students a culture of open science. Yet again, this is accomplishable by scheduling more frequent lab meetings as means to more openly expose my peers' *internal research data* to one another. But because heightened secrecy is presumably motivated by possible commercial rewards

[271] Available at: http://careers.bmj.com/careers/advice/view-article.html?id=2631 (last accessed 7/29/2012).

from research, and according to the published empirical data appears to be a culturally ingrained, and therefore unavoidable, phenomenon among lab researchers nowadays, I can suggest a policy in my lab that encourages my students and peers to share with *all* researchers in the lab any monetary rewards reaped from university-industry alliances.

Fourth, I am committed to discouraging among my students a culture of noncompliance for requested biomaterials. The empirical data presented in Chapter 7 shows noncompliance to occur between *different* – not within the *same* – university research labs[272]. But the data does not mean that noncompliance does not occur among lab researchers within the same university research lab, including my own. This is not unrealistic given the current prevalent culture of competitiveness among lab researchers against the backdrop of the *technological triumvirate* and, more broadly, neoliberal policies of privatization.

Since noncompliance for requested biomaterials is essentially a form of secrecy (or withholding) that concerns tangible biomaterials as opposed to intangible data and knowledge, my *resistance approach* to tackle noncompliance *within* my lab[273] is the same for that for heightened secrecy.

Fifth, and finally, I am committed to minimizing publication delays imposed by industry on my lab's *internal research data*. We learned in Chapter 1 that, at the point of publication, a lab's *internal research data* invariably flows into the global *external research data* pool in the form of a published paper that is archived in *online* bibliographic databases. Therefore, publication delays impede – at the global level, and in real-time – the general progress of scientific research; delays on publications containing one lab's *internal research data* momentarily deprive other labs in the same research field of that data. Moreover, a given piece of delayed data can represent a pivotal piece of the jigsaw puzzle for another lab, causing a momentary stall in their research – and, in turn, the entire global research field – as they strive to discover that missing piece of the puzzle for subsequent publication. But publication

[272] Recall, noncompliance for requested biomaterials occurs when a university lab researcher from one lab requests, and is subsequently ignored or declined, a research tangible (e.g., reagent, antibody, printed DNA sequence) from a lab researcher in a different lab.

[273] As is in the case of heightened secrecy, I have no control over the capitalist tendencies of lab researchers *external* to my lab who engage in noncompliance for requested biomaterials with my peers.

delays not only have an adverse impact on labs conducting research similar to a lab with an imposed publication delay; labs in other research fields are adversely affected because publications often contain novel experimental methodology that, because of its broad and standardized nature, is applicable to many diverse research fields.

Here, my *resistance approach* involves resisting the capitalist way in which industry delays publication of a paper produced by a collaborating university research lab in order to protect the commercial value of the knowledge contained in the paper for industry's own commercial exploitation.

It seems as if very little can be done to resist publication delays if the university research lab enters into a *contractual* agreement whereby industry enforces a delay. But there are realistic alternatives to this scenario. For example, one obvious solution is for the lab educator to refuse to sign a publication delay agreement, and to alternatively negotiate with industry that they, or the university, patent the knowledge *prior* to publication as a means to protect that knowledge from commercialization by others. However, if it is a pending patent application that is the reason for industry imposing a publication delay, then I propose that the paper in question can still be published in a timely manner and prior to the patent being filed if the most commercially lucrative data contained in it is codified.

For example, instead of using universal scientific nomenclature, such as the literal name for a gene, the publishing lab could use a pseudonym in order to disguise a particular gene or DNA sequence. However, I realize that codifying knowledge in this manner defeats the purpose of the knowledge, in its explicit and open form, being utilized by the global scientific community. So to address this issue, the publishing lab can note in the paper that the codified knowledge contained in it will be available to the scientific community in entirely *uncodified* form upon patent approval of the knowledge; i.e., the point at which the knowledge is, technically, legally protected from commercial exploitation by others.

Thus, my *resistance approach* could be a powerful tool to utilize to resist the capitalist motivations of industry responsible for closed science in the *postmodern university* research lab[274], whilst preserving the crucial collaborative relations between

[274] Resistance in this manner towards industry-mediated closed science in the *postmodern university* research lab will, technically, revert the university from a postmodern to a historic institution, because you will recall from Chapter 6 that industry's erosion of the university's public sphere is a central criterion in the rise of the

the two. The result is a tilting of the balance of the *contradictory convergence* from closed science more towards open science as a means to reclaim the democratic ideals of learning in the lab. As for the wider university, at least in the context of the sciences, I believe it is not in ruins; it is merely adapting to contemporary society. If it did not adapt it *would* be in ruins. However, if the university adapts too much, by granting greater power to industry in its affairs, it *will* be in ruins. Hence, this balance between adaption and *over*adaption to contemporary society is crucial to the university's current precarious and future position in society. As lab educators, if impassioned, we have a moral obligation to monitor this delicate balance, which can realistically be kept in check with the rational implementation of my *resistance approach*.

But to be truly effective, lab education must entail teaching science students' awareness of the *technological triumvirate* in order to prepare them for the potential obstacles in the path of their research, and to garner support for collective resistance to such obstacles. Importantly, Crittenden (2007: 10) states that 'political action through education cannot take place in a vacuum'; hence, the lab educator must transcend the political confines of their university to mobilize – using broader political bases like the AAUP – activism in, and *across*, the field of higher education in order to see real change. But grave challenges lie ahead. For the AAUP's online mission proudly (and perhaps ignorantly) proclaims 'higher education's contribution to the common good'[275] – i.e., 'common good' in the *social* sense. In reality, though, as the dissertation has demonstrated, this is far from true given the intrinsic commercialization embedded in '*heightened* common good' – i.e., 'common good' in the *economic* sense – to describe *internal research data* generated in the context of the *technological triumvirate*.

Indeed, the contemporary commercial exploitation of *hard* and *soft* technologies to sell university *internal research data* in the context of a knowledge economy and against the backdrop of the *control* technology of neoliberalism is, as the dissertation comes full circle, consistent with Heidegger's (1977) concept of

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postmodern university. But such a reversion, even if enacted by myself and many of my colleagues, would require collective *university-wide* resistance towards closed science. As this seems unrealistic (at least for the immediate time being), given the complexity on which my *resistance approach* rests, or perhaps because of its inaccessibility, I preserve use of the label *postmodern university*, even when I describe action that somewhat undermines the very practical criteria used to coin the label.

[275] Online resource available at: http://www.aaup.org/AAUP/about/mission/ (last accessed 7/29/2012).

'challenging-forth'[276]. In Chapter 2, I alternatively conceived 'challenging-forth' as a *proactive bringing-forth*, which is my cue to the apparent capitalist premeditation laden in the mind(s) of those involved in the design, creation, and/or implementation of a given modern technology. That the mode of revealing for modern technologies – including *hard*, *soft*, and *control*[277] technologies, which have revolutionized learning in the university research lab inasmuch as they have, ironically, undermined it – is inextricably tied to capitalist premeditation is not surprising given the global grip of capitalism and the associated popularity of state-adopted neoliberal policy. Such is a sign of our postmodern times. And such is the story of the '*technological triumvirate* of university-industry alliances'.

[276] Recall, 'challenging-forth' contrasts to (the more passive) 'bringing-forth', which is the mode of revealing for ancient technologies (Heidegger, 1977).

[277] However, the notion that *control* technologies are exclusively modern technologies (or 'contemporary', in order to avoid confusion with the modern era) is contestable given that humans *are* control technologies, whereas *hard* and *soft* technologies are not, although these are indeed conceived, manufactured, and exploited by humans. Therefore, presumably *control* technologies have existed since the advent of humanity; indeed, feudalism is a good example of a *control* technology that *predates* contemporary times (see Chapter 4).

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