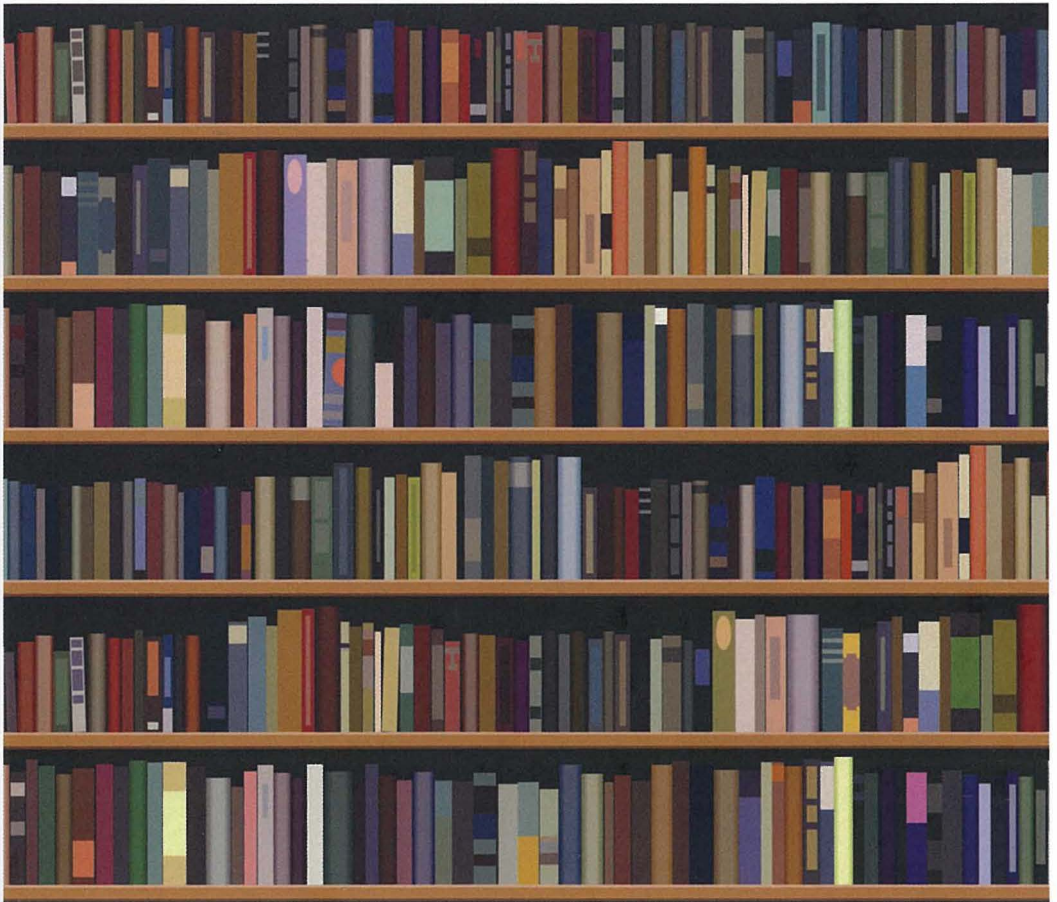


Universities and Innovation Economies

*The Creative Wasteland of
Post-Industrial Society*

Peter Murphy



UNIVERSITIES AND INNOVATION ECONOMIES

This book is dedicated to my father, Harry, who was a gifted engineer and who imparted to me something of the engineer's respect for how things are rather than what we might wish them to be. If an engineer ignores the reality of the forces of nature, the bridge falls down. So it is with society. If we ignore what is possible and what is practical, our social bridges collapse under their own weight.

Universities and Innovation Economies

The Creative Wasteland of Post-Industrial Society

PETER MURPHY

James Cook University, Australia

ASHGATE

© Peter Murphy 2015

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.

Peter Murphy has asserted his right under the Copyright, Designs and Patents Act, 1988, to be identified as the author of this work.

Published by
Ashgate Publishing Limited
Wey Court East
Union Road
Farnham
Surrey, GU9 7PT
England

Ashgate Publishing Company
110 Cherry Street
Suite 3-1
Burlington, VT 05401-3818
USA

www.ashgate.com

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

The Library of Congress has cataloged the printed edition as follows:

Murphy, Peter, 1956–

Universities and innovation economies : the creative wasteland of post-industrial society / by Peter Murphy.

pages cm.

Includes bibliographical references and index.

ISBN 978-1-4724-2535-5 (hardback) – ISBN 978-1-4724-2536-2 (ebook) –
ISBN 978-1-4724-2537-9 (epub) 1. Education, Higher—Economic aspects. 2.
Postmodernism and higher education. 3. Educational change. I. Title.

LC67.6.M88 2015

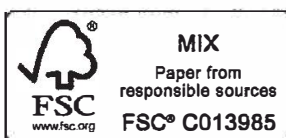
338.4'3378--dc23

2014028902

ISBN 9781472425355 (hbk)

ISBN 9781472425362 (ebk – PDF)

ISBN 9781472425379 (ebk – ePUB)



Printed in the United Kingdom by Henry Ling Limited,
at the Dorset Press, Dorchester, DT1 1HD

Contents

<i>List of Figures and Tables</i>	<i>vii</i>
<i>Acknowledgements</i>	<i>ix</i>
Introduction	1
1 The Creativity Deficit	15
2 The Innovation Economy	59
3 The Bureaucratic University	91
4 The Discovery University	143
5 The Social Mirage	169
Conclusion	215
<i>References</i>	<i>233</i>
<i>Index</i>	<i>253</i>

List of Figures and Tables

Figures

1.1	Science, Social Sciences, Humanities: N-Gram Analysis of the Annual Incidence of Key Words in the Google Book Database	46
2.1	The Rise of Management: N-Gram Analysis of the Annual Incidence of Key Words in the Google Book Database	89
3.1	The Language of Bureaucracy: N-Gram Analysis of the Annual Incidence of Key Words in the Google Book Database	142

Tables

1.1	Key Figures by Decade of First Major Work	19
1.2	Key Works in the Humanities and Social Sciences by Decade in the Twentieth Century	25
1.3	Key and Significant Painters by Decade in the Twentieth Century	28
1.4	Key Figures by Century of First Major Work	31
1.5	Academic Publishing Growth Rates	44
1.6	Arts and Humanities Publication Output by Year	49
1.7	Major Science Discoveries by Century	51
2.1	Labor Productivity Annual Average Growth Rate	73
2.2	Citation Rates by Field	83
3.1	Staff–Student Ratios	138
4.1	Publications per FTE University Academic Staff Member, 2003–2007	147
4.2	Institution Type and Research Output	163
5.1	CEO and Academic Remuneration	191
5.2	How Many Books a Year Do You Read? (US Gallup Survey)	207

Acknowledgements

My sincere thanks to: Greg Melleuish, Ken Friedman, Vrasidas Karalis, and David Roberts, who read and commented on the book in manuscript. Warm thanks to Simon Marginson with whom I worked on a research project about universities while I wrote *Universities and Innovation Economies*. Other colleagues have also been generous with their thoughts about universities, creation and innovation—among them Anders Michelsen, Agnes Heller, Dominique Bouchet, Eduardo de la Fuente, John Carroll, Chris Hay, Paul Collits, Ian Atkinson, Wayne Cristaudo, Doug Kirsner, Celia Lury, Andrea Vestrucci, Mujadad Zaman, Warwick Powell, Tina Besley, Ryan Daniel, Scott Lash, John Rundell, Xinxin Deng, Ron Barnett, Suzi Adams, Gerard Puccio, Peter Beilharz, Katja Fleischmann, Hong Chengwen, David Salisbury, Craig Browne, Glenn Porter, Susanne Maria Weber, Michael Peters, Andrew Benjamin, Brian Nelson, and Trevor Hogan. I am grateful to those colleagues for their observations and reflections—and to Robin Gauld and Sian Supski who assisted me in the collection of data for this volume.

Introduction

The Creative Wasteland of Post-Industrial Society

The global financial crisis of 2008 signaled the beginning of the end of the post-industrial age. The prolonged stagnation that followed 2008—accompanied by sovereign debt, low productivity and high unemployment in major economies—was an indication of the failure of many of the claims that had been made since the 1970s about the economic power of post-industrial economies and knowledge societies. Economic failure translated into fiscal contraction. This affected all kinds of government spending including on a super-sized university sector. During the post-modern era, mass higher education had grown ferociously. Philosophies of post-industrialism legitimated a relentless expansion of government budgets for education along with other social sectors. The resulting levels of sovereign debt and government budget deficits were not sustainable—not least because the economic promise of post-industrial economies was never realized.

The promise of post-industrialism was innovation. The primary cause of modern economic growth, the theory went, was innovation. Innovation is the social application of the power of creation. Modern societies that lack the capacity for creation struggle socially and flounder economically. The theory was not wrong. The extended economic stagnation in many OECD countries that followed 2008 was a symptom of depressed innovation. But this despondent state pointed to a deeper problem: namely that the post-industrial ‘knowledge society’ and the post-modern ‘information society’ had stopped innovating on a large scale—or rather it had never lived up to its self-image as an innovating epoch. The ‘bio technology revolution’ that was promised in the 1990s failed to happen. The 2000s saw mass consumer enthusiasm for social media, computer applications and smart phones. Yet the last significant productivity increase in the OECD occurred in the late 1990s and that was short-lived. The university was the symbolic core of the post-modern age. It embodied its desires. It represented its aspirations. It was emblematic of the knowledge and information that, supposedly, elicited the technological and sociological innovations that energized economies and enlarged social prosperity. It was an institutional source of concepts that animated and unscored the ideas-driven growth that supposedly typified post-industrial economies. Yet in reality growth, prosperity and ideas proved to be much scarcer than in the industrial age.

Part of the explanation of this is bureaucracy. The post-modern age promised to replace inflexible ‘Fordist’ organizations with flexible ‘post-Fordist’ institutions. In reality, post-Fordism out-did Fordism in its fascination with administration. This was, above all, true of universities. Post-modern bureaucratic organization

contributed much to the failure of contemporary innovation and the paltry nature of its idea-generation. Large and medium-sized organizations dominate today's economic and social landscape. Yet, whatever their virtues, these organizations are typically poor innovators and miserable concept-producers. Smaller enterprises and informal milieu for the most part are better at substantive innovation and genuine creation. That does not stop large formal organizations touting their innovation prowess in ways that are both self-serving and self-deluding. A specious rhetoric of innovation deployed by bureaucratic organizations and bureaucratic societies took off in the early 1970s. This coincided with the rapid expansion of universities. The peak of social discussion about universities occurs in the period between 1967 and 1974.¹ This was one of the harbingers of the post-modern society. The effect of this interest and its concomitant rhetoric was perverse. It contributed to hollowing out the inner substance of innovation and creation while appropriating its legitimating properties. Large organizations not least of all the ever-expanding universities proclaimed (without much evidence) their own impressive novelty and freshness. This shameless booster mentality belied an underlying reality of exhaustion and entropy. All round there was much sound and fury that signified nothing.

Modern economies are cyclical. The most important cycles are the long economic waves. These last 70–80 years and define the world's mega-trends. We have just come to the conclusion of one of those waves. It began in 1950 and ended in 2010. It started on an upswing and terminated in chronic stagnation. There were good times during the era but sluggish periods as well. Some of the good times hid bad practices. Consequently a good portion of the wealth created in the 1990s and the 2000s was fictional. It was the product of speculation rather than ingenuity and hard work. The overlapping long economic waves of 1900–1970 and 1950–2010 were notably less impressive in real terms than the waves of 1780–1870 and 1850–1920. While the global economy is wealthier today than it was in the nineteenth century, its creative energy is less.

Where do we go from here? What can help restart the stalled engine of creation and re-engage yet another long cycle of creative capitalism? Can the spirit of the nineteenth century be recaptured, or will the world's next long economic wave prove to be more down than up? The answer to that question lies in one word: productivity. Productivity is the child of creativity. The secret of modern industrial capitalism was to create more with less. To achieve more with less, science was applied to production, commerce was freed from government bureaucracy, the work ethic spread, and social institutions were stream-lined. In the twentieth century, a counter-thrust occurred. Late twentieth-century science was consumed by the art of grant-getting and rent-seeking. State capitalism rose to prominence. Hedonistic and remissive behaviors were widely sanctioned while increased regulation petrified flexible institutions.

The idea of social and geographical mobility driven by education, and culminating in 'going to university,' proved to be one of the most powerful post-second world

1 Google N-gram analysis of the terms 'university' and 'universities.'

war ideologies. Across the OECD, 30 percent or more of 19-year olds now attend tertiary institutions. Ready access to higher education prevails. The underlying assumption is that education-fuelled social and geographic mobility is ennobling. It emancipates human beings from a life of labor and enriches the mind. But does it? Students often acquire proficient professional knowledge in contemporary universities yet these same universities now also often bore the brightest students. At the same time, 25 percent of students drop out of university permanently without completing a degree.² Another 25 percent of students graduate but never work in a job requiring a degree. While the post-industrial universities redefined themselves as vehicles of social and spatial mobility, their ability to satisfy the most inquiring minds or produce path-breaking work diminished, as did their vocational salience.

This kind of unseemly roundabout was not peculiar to universities. It haunted much of the electronic age. A peculiar ambivalence beset the era. It saw out socialism and communism. Both were dead ducks by 1989. But the age could not let go of their asphyxiating legacy. So it turned from anti-capitalism to various kinds of faux capitalism. A legion of *fauxitalisms* mushroomed. These were encouraged by government subsidies, preternaturally-low interest rate policies and ideologically-inspired regulatory environments. The financial crisis of 2008 signaled the beginning of the end of the post-industrial age. We are starting to look back on it now. What we see in hindsight should inform the future. Times do pivot and behaviors do change. We cannot foretell the future but should the future turn out better than the past this will be because we have learnt something from experience. We do not know what the next economic wave will be. It is being invented right now. The open question is whether, as a result, the creativity slump of the post-modern era will be overcome or not?

Post-modern sin was two-fold. First, it was not to go to university. Second it was not to invest large amounts of private and public money in the vain pursuit that everyone should attend a college or university. Accordingly, the higher education sector attracted untold billions in tax-payer funds and student fees. Yet what it delivered to millions of individuals and the larger society was paltry. Drop-out rates were intractably high. On a mass scale, these rates were socially and financially unsustainable.³ A quarter to nearly a half of graduates ended up in

2 In 2011, the comparative figure for the United Kingdom (one of the world's better performers) was 21.6 percent. Paton 2012. The OECD, 2007, Table A3.4, calculated that 72 percent of Australian university students completed (28 percent didn't) by measuring graduates as a percent of entrants for the year. The OECD average, on this measure, was 69 percent completion. The United States had 56 percent completion and the United Kingdom 79 percent completion. The OECD, 2013a: 68, reported completion rates of 80 percent (Denmark), 74 percent (Germany), 66 percent (Israel), 64 percent (USA), 59 percent (Norway), and 47 percent (Hungary). Australia's rate in 2013 (81 percent) was arbitrarily high due to rapidly growing entry numbers.

3 In 2013, 37 million Americans (about one in 10) had some college credits but had not completed a degree.

jobs that did not require a degree.⁴ Chronic grade inflation diluted the meaning of entry scores and performance results. After 1970, real research output per capita declined visibly and the rate of high-level creation diminished noticeably. Major breakthroughs in key areas from physics to medicine contracted.

When it comes to analyzing the universities, the current study draws principally on evidence and examples from Australia and the United States. The latter is a diverse higher education system with both public and private institutions; the former is a predominately state university system. The American system is large and leads the world; the Australian system is small but is strong academically and is a major exporter of higher education internationally. Yet both face serious systemic problems—as do university systems across the world. The problem lies not with this or that country but in the nature of the university and especially what became of it in the post-industrial era. The university was the signature institution of the post-industrial age. The age reaped what it sowed. As the last long economic wave unfolded between 1950 and 2010, universities expanded remorselessly. As they did, their intellectual productivity declined. They become massively bureaucratized. Their information technology proved dysfunctional. Central costs ballooned while governments mercilessly drove large numbers of young people who had no interest in and no aptitude for university curriculum into the universities. Today the clear evidence is that half of university entrants show no improvement in reasoning or understanding across their first and second year. In effect, they learn nothing. Half also either drop out of university or else are never employed in a job that requires a degree. What would we say of a factory that produced 50 percent unusable widgets? We would say it had a productivity problem. All the serious empirical indicators suggest that too many young people today go to university or degree-granting colleges not too few, and that the *raison d'être* of universities has been lost amidst a fog of fake social pieties, insipid intellectual activity, and illusory promises of social advancement.

Governments funded the remorseless expansion of the universities.⁵ In doing so, they created problems that they could not afford to fix. They raised expectations that more and more young people would go to university, far in excess of population growth. None of this was sustainable.⁶ So governments did one of three things.

4 Forty-eight percent of US college graduates in 2012 were in jobs that did not require a degree. Vedder, Denhart and Robe 2013.

5 The breathlessness of government reports that hailed the expansion began early on. In 1964 Australia's Martin Committee reported that 'since the end of World War II, there has been a revolution in the interest in higher education in Australia' (volume 1: 12) inciting images of an implacable flow that all subsequent government inquiries would in turn summon up. The separation between fact and norm blurred. The Martin Committee was the second of Australia's major official inquiries into its universities in the post-war period.

6 In 1947 Australia spent 0.11 percent of its GDP on the universities; in 1962 this had risen to 0.67 percent (Martin Committee 1964 volume 1: 13). In 2011, the expenditure was 1 percent. In 1947 the outgoing was fiscally inconsequential. In 2011 it was fiscally noticeable and thus subject to political considerations.

They borrowed the money to fund university places, exacerbating long-term public debt problems. They introduced ‘fees-and-loans’ packages for students, creating unproductive private debt for the many students who would eventually drop out of university or never use their degree in a job. Finally, governments systematically underfunded student places. This careless system undermined the intellectual productivity of the university in the name of expanding the university. It financed millions of people to learn approximately nothing while those who were in a position to seriously benefit from a university education were habitually short-changed by the skimpy curricula and ballooning size of the mass university.

The post-industrial era stimulated a raging social appetite for higher education. In the wake of this, the word ‘university’ became a synonym for virtually any kind of tertiary education of any description. The university subsumed the college, the technological institute, the seminary, the gallery school, the conservatorium, and the sports team. In so doing it radically expanded the range and (more importantly) the type of discipline it offered. Management, media, and business ‘studies’ joined physics, economics and philosophy in the university. Yet it remained an open question whether the four-year undergraduate university degree was a suitable replacement for on-the-job training in the para-professions such as journalism or social work. Nevertheless, the status of the word ‘university’ is very seductive. As a consequence the institution of the university has continued to proliferate inexorably while the universities on average have become more and more trivial in their spirit and practice. A handful of universities escape this fate. Most do not.

Universities are defined by three great functions. One is to transmit knowledge in order to provide students with an understanding of the humanities, the sciences or the social sciences. The second function is to transmit knowledge in order to prepare students for a learned profession. The third and highest function of the university is to create knowledge. The university thus is defined by the advancement as well as the transmission of knowledge. A university that advances knowledge is different from a humanistic college or a vocational institute. The latter principally convey knowledge rather than create it. The discovery university (the type of university that advances knowledge) relies on high levels of self-education and intellectual modelling. A firmer or clearer distinction between the discovery university (on the one hand) and the humanistic college or the technological institute (on the other hand) might help to resolve some of the conundrums that we currently face as a consequence of the repeated inflation of the concept of the university. We cannot escape the simple reality, though, that a large portion of what today is called ‘the university’ is not a university at all.

The problem is not new. The modern idea and practice of the university took shape in the nineteenth century. What resulted from that was an institution (even then) whose self-understanding and practices were ambivalent and conflicted. The American university scene of the late-nineteenth century had all the features in miniature of what was to come. It was torn between vocational and scholarly study, undergraduate and graduate missions, professional schools and the liberal arts and sciences, the advancement of knowledge and the diffusion of knowledge,

professional training and intellectual calling, pure and applied knowledge, wide curricula choice and narrow disciplinary specialization. It prepared students for the learned professions (originally divinity, law and medicine) while opening the university to vocations that aspired to professional status. Programs for musicians, dieticians, pharmacists, teachers, veterinarians, social workers and business administrators sprang up. Some of the new professions, like engineering, matched the intellectual demands of law and medicine; others struggled (and still struggle) for credibility. And the question of how the ‘lower faculties’ related to the ‘higher faculties,’ how philosophy related to law, or science to engineering, or the liberal arts to the professions was never resolved. Did a new discipline like that of business belong in a professional ‘school’ or in a ‘college’ of liberal arts and sciences? What in any event was the relation or separation between the words ‘school,’ ‘college,’ ‘institute,’ and ‘university’?

Overall, ‘the university’ belies its name. It has evolved as a disjointed and jumbled institution, with a fractured identity, often united by one thing only: the desire to grow ever-larger. The post-industrial era exacerbated and compounded this tendency, often radically. Excess was its middle name. The consequence of the post-modern age was to blur still further the idea of the university. It did this on a very large, concerted scale. It accelerated and magnified a process that turned the university into the multiversity and then into the megaversity. The institution of the university became all things to all people. Distinctions between training providers, colleges, polytechnics, technological institutes and universities blurred. Intellectual goals vied with social goals and vocational goals and expansionary goals. This all gelled with the conceptual relativism of the age. Haziness, confusion, and muddle reigned.

The post-industrial age witnessed some counter tendencies. Between 1974 and 2004, across the world, the term ‘research university’ gained ground.⁷ Self-described ‘research universities’ began to assert their identity. Since the creation of the University of Berlin in 1810, there had been a presumption that a university was a place where research happened and knowledge was advanced. Yet this idea of the university always sat uneasily with collegiate-style teaching universities and vocational-style technological universities along with the professional ‘schools’ and undergraduate ‘colleges’ of universities, and a myriad other half-way houses, suggesting that the idea of the university has been one of the most contested and confused ideas in modernity. Everyone one desires the status that research confers because only a relative handful of the members of a university routinely produce research. Not only that but also a tiny number of universities produce most of the world’s academic research. The sudden emergence (in the mid-2000s) of global rankings of universities merely highlighted this. While at the other end of the spectrum new versions of the ‘vocational university’ proliferated (especially in East Asia) whose rationale was that graduates would get ‘jobs.’ In between these two poles sit most universities who are uncertain of their identity and who rely on

7 Google N-gram word analysis search.

vague notions of ‘scholarship’ to bridge what is for most purposes an unbridgeable gap between intellectual discovery and job training. Most of these institutions claim to do research but in practice produce little of it. All in all, that suggests the need for a more affirmative and systematic distinction between the discovery university, the humanistic arts-and-sciences college and the technological institute.

‘Polytechnic,’ ‘technical college,’ ‘college of advanced education’ and ‘institute of technology’ are still today much more accurate words to describe many of the institutions that are called ‘universities,’ no matter that these labels have fallen into disuse. The astute US Carnegie classification of research, doctoral, and comprehensive universities indicates the difficulty of answering the question: ‘what is a university?’ Research universities give priority to faculty carrying out research; doctoral universities have at least a number of major doctoral programs but without an emphasis on faculty research; comprehensive universities offer graduate research degrees to Masters’ level. Is a university then defined by the conduct of research or can it be defined by the quasi-teaching function of supervising graduate research students?

The confusion of naming has been caused in no small measure by the social desire to expand universities. By the mid-2000s, this expansionary impulse had turned into a hubristic ambition that 30, 40 or 50 percent or more of 19 year-olds attend university. This was invariably tied to post-industrial claims about achieving ‘equity’ in higher education; claims that only ever produce ever-larger equity bureaucracies, never ever-greater equity. Post-industrial equations of degree-granting with the advancement of learning (in turn) with the advancement of knowledge (in turn) with economic advancement proved a chimera. The post-industrial era achieved little more than the proliferation and inflation of qualifications and the moral disenfranchisement of those without them. Post-industrial higher education promised social equality but more commonly produced unrepresentative, obsequious, and morally-smug meritocracies whose actual merit was difficult to determine. It acted as a model for the wider bureaucratization of social systems in general and the zealous over-extension of procedural rationality in society. The post-industrial university failed to deliver on any of its social equity talk. Its failures then became the justification for repeating more of the same. After 1970, universities promised to match the percentage of low socio-economic status (SES) student enrolments with the proportion of low SES individuals in the general population. Forty years on, the universities had failed to do this almost completely. All that equity policy did was to generate university equity bureaucracies in which university graduates were employed. This was a microcosm of a wider social phenomenon that saw the multiplication of public spending on procedure and process and the consequent proliferation of null offices with exorbitant titles occupied by graduates to no good social effect.

More compelling than the self-interested promises of equity bureaucracies is the auto-poietic model of educational attainment. Bureaucracies seek procedural and institutional solutions to problems that cannot be solved by organizational means. Advancement to university is a classic example of this. Institutional policy

techniques such as lowering or manipulating entrance requirements, setting entrance quotas, multiplying the number of places in universities, offering special (aka non-meritocratic) scholarships and income support, and so on, make little or no difference to social outcomes. This is because advancing to university is not a generic social process but rather a socio-intellectual one. The single most powerful predictor that an individual will get to university is not parental status, income or occupation. It is the size of the home library that a child has access to. If one wants to attain equity of entry to higher education then the familial-bibliophilic model of educational attainment is a more realistic way of achieving this. This is comparable with the efficacious role that self-education plays in the lives and careers of creative individuals in the arts, sciences and the professions. Rather than bureaucratically-driven 'access' programs, bibliophilic programs that support reading at home (such as investing in public libraries) are more effective in achieving broad educational success. There is good reason as well for skepticism about bureaucratically-delivered schooling. Bibliophilic self-education combined with familial inculcation of time-management and other key behavioral and character traits is central to getting to and succeeding at universities. Post-industrial obsessions not only with schooling but also with social media have endangered this. There is a close correlation between the pervasive rise of social media and the critical collapse in hours spent reading at home in recent times. Just as institutionalized schooling is no guarantee of learning, equally questionable is the proposition that 'more places at universities' means 'more social opportunity' and 'greater life chances.' In reality, 'more places' in the post-industrial universities has simply meant less and less learning going on in those institutions. The post-industrial equation of ever-higher formal levels of education with better learning outcomes, better graduate incomes, and better economic performance or social prosperity is fallacious. For the present, the mythologies of the post-industrial society keep social demand for university places in OECD countries high. But myths are not forever and realistic questions keep being raised: How can demand, outcomes and the fact of shrinking government budgets be reconciled? How (then) are scarce public resources to be allocated?

If resources are scarce, to whom or what should those resources flow? This is a classic question of public policy. What criteria do we have to help us choose between what we spend money on and what we don't spend money on? There is reason to consider sympathetically the criterion of discovery. Discovery is a public good. Done in a serious way it produces tangible, long-term, collective social value. It represents the human capacity for initiating, preserving, inventing and finding what is significant. Discovery, though, is not a populist criterion. While the fruits of discovery are widely shared, the human talent for discovery is not broadly distributed in society. Psychological studies of creativity and intelligence persistently conclude the same: around 8 percent of the population has a clear and evident gift for intellectual discovery. Around 16 percent of the population will end up in the professions and the semi-professions (combined) and that cohort benefits from some kind of higher education (though it may not be a university

education in the strict sense of the word university).⁸ A similar percentage of 19 year olds are ‘college-ready’—meaning that there is a high probability that they will successfully complete their tertiary studies. Discovery is not for everyone. The modest-sized discovery cohort is proficient at abstract thinking, reasoning, and speculation. It is comfortable with university-level curricula. It works with a substantial degree of intellectual autonomy and self-direction.

At the highest level, what results from informed self-direction—namely, invention, innovation, and initiative—is generated by a small number of researchers, writers, scientists, technologists, artists, political actors, policy makers, and leaders of the professions whose work, by its nature, is publicly communicated and widely diffused. There is an outward in-principle reason for society to support higher education especially of the 8 percent discovery cohort, and most especially its 2 percent high-performing core, because what that cohort creates has a general, transferable and durable social value. That said, though, post-industrial subsidies (as the current study shows) over time have only made higher education more expensive not more accessible. In other words, state subsidies in practice have been counter-productive and self-defeating. In the post-2008 era, scarce public finances can be best and most effectively used for limited, targeted, merit-defined support of higher education and principally of discovery universities.

The size of the discovery university sector is inherently small.⁹ Historically the university sector as a whole was small as were universities as institutions. The

8 Australia’s Martin Committee (1964 volume 1: 12) asked in passing the useful question: ‘Should the nation make facilities available to all students wishing to become doctors or engineers or lawyers, if it is doubtful whether the community will need this number?’

9 This view may be contrasted with that of Australia’s Martin Committee. In 1964, the Committee stated that: ‘Some of [the] disadvantages of large institutions are inevitable and they should be set against the possible advantages of size. The truth is that there cannot be an optimum university size, for there are no agreed criteria against which to judge size’ (volume 1: 54). However, if the extent of discovery, productivity, and efficiency are the agreed criteria, then a ‘large’ university is not optimum. It is notable that the Protestant universities that were the engines of the European Enlightenment were small institutions. A case in point is the Scottish Enlightenment. Its great universities, the University of Glasgow and the University of Edinburgh, in the eighteenth century had 400 and 600 students respectively, about 1 percent of their cities populations. These universities led the way in philosophy and medicine, harbouring figures like Hume and Hutcheson, Adam Smith and Adam Ferguson while the southern counterparts of these institutions, the much larger Oxford and Cambridge universities, were in the doldrums. (Instructively, Adam Smith cut short his stay at Oxford where he had gone to carry out private scholarship on a very generous post-graduate Scottish scholarship.) Size is not the only cause of university lethargy but it is a factor. A city or region with a population of 1 million warrants a university with a student population of 10,000 students. That is around the maximum size of a proficient university today. Six-to-eight thousand students is the optimal size for a contemporary university. Significantly larger growth engenders progressive entropy, beginning with disproportionate transaction and process costs. Structural factors like multiple campuses magnify entropic cost growth.

importance of this is unchanged. The future of the sector lies not with the megaversity or the multiversity but with the microversity. The demands of the microversity on the public purse are properly modest. It is defined by a visible and tangible commitment to intellectual discovery and by a distinctive style of autodidactic exploration-based learning. This mode of education supposes motivated self-learners who advance in their studies via a vast range of extra curricula intellectual activities and through the medium of exploratory research-based essays, artistic works, science experiments, and theses. The latter are supervised by a professoriate that provides both undergraduate students and graduate candidates with visible and credible models of imaginative research and inspired discovery. Competitive scholarships are the most effective means available to governments to support and fund discovery-based higher learning. A system of scholarships—awarded on the basis of scholastic and creative aptitude tests—can properly underwrite both full fellowships and subsidized university places. The rationale for the state and society doing this is that discovery is a clear and demonstrable public good from which all, including future generations, benefit.

The discovery sector is tiny. It is not for every student who might benefit from higher education. The technological institute and the humanistic college naturally complement the discovery university. Those who might benefit from some type of higher education are the college-ready 16 percent who have a good probability of completing a degree or working in a vocation that requires a degree. This applies to around half or less of the number of students today in higher education. Higher education is a mixed private and public good. For graduates, a higher education provides intellectual self-enrichment and leads to professional, skilled para-professional and office work as well as higher incomes on graduation and higher social status. For employers higher education sorts aspirant employees. The state's responsibility is limited in most cases. The exception is the exceptionally talented whose capacity for intellectual discovery and professional initiative provide a manifest long-term public and social benefit.

The public purse is not unlimited. It should not encourage over-education, as today, with millions of students enrolling in higher education with faint chance either of graduating or ever working in a job that requires a degree. Loans for tertiary study—repaid as a taxable percentage of graduate income—are an efficient way for able individuals to pay for a university place, allowing them to defer payment of fees and expenses until they are working. The over-expansion of the post-industrial university, though, created ballooning student debt. A large number of those who are indebted gain no rational private benefit from this debt. Student debt today has started to become a cause of marriage postponement, home loan unaffordability, and delay in the beginning of families. It also eats into the modest capital needed for garage-scale business start-ups. This suggests that not more but fewer university places per capita are needed. University places cannot replace jobs nor can they replace workplace apprenticeships, traineeships, cadetships, paid internships, and small business start-ups. The latter are more valuable now to those wanting to enter the workforce than the ever-decreasing marginal returns

of ever-more university places, be these privately or publicly funded. The proper principal function of public policy is to aid in the creation of jobs, not university places. The chief economic illusion of the post-industrial age was that the latter could replace, stimulate, and generate the former.

The carrying-out of research defines a university. Yet most post-industrial universities produce meagre amounts of research. They are in reality teaching institutions, i.e. de facto colleges or institutes. They principally function to transmit knowledge, not to create knowledge. Even then their rates of retention of undergraduate students are often poor and their record of graduate employment placement is mediocre. In the post-industrial era, non-academic professional and administrative costs grew from 40 percent to 70 percent of university budget spending while university performance measured against key indicators remained static or declined. Most serious of all, the models of post-industrialism promised the vitalization of creative economies and societies. The converse occurred. Per capita rates of discovery in the arts and the sciences declined in the post-industrial era. Fewer major works of note were produced compared with earlier historical periods. Political concern with providing more and more university places had detrimental effects. It muddied the social goal of advancing knowledge. It moved focus away from high-level creation and discovery—even when (in doing so) it deployed the rhetoric of creation and discovery. OECD countries in 2008 were less creative and less proficient in the arts and sciences than they were in 1908. By way of illustration, the US rate per capita of patent registration peaked in 1914. Since the discovery of the DNA double helix by Crick and Watson in 1953, the per capita number of high-level science breakthroughs has diminished markedly. The half-life of contemporary scientific knowledge is short—meaning its obsolescence factor is high. Much of its experimental results are never verified and the failure rate of retested results is also high. While universities expanded massively during the post-industrial era, per capita research productivity inversely declined. No more than 20 percent of ‘teaching and research’ academics in OECD universities routinely produce research, even if most relish the kudos and social status of a discovery university.

A common theme highlighted by extant studies and biographical accounts of creative figures in the arts, sciences and the professions is self-education. High-level creators flourish when they have access to first-class libraries and laboratories and first-class intellectual models. Together, these provide a powerful context for the adventive mind. The twin imperatives of self-education and intellectual modelling animate the forms, structures, expectations and needs of the autodidactic discovery university. Its overarching goal is discovery. Its meaning and motion derive from this goal. A university of this kind provides its students with an apprenticeship in discovery. There are many techniques for achieving this. Large libraries, broad curricula, interdisciplinary freedom, one-on-one research-based tutorials, small seminars, public lecture series, project-based learning, research-based assessment, and student-staff societies are common examples. Most important though is a pervading ethos of inspired objectivation. The auto-poietic university is a place for

learning how and witnessing how the act of creation takes place. That requires the direct observation of acts of discovery as they happen, as professors write books, conceive experiments, give papers, submit articles, posit artworks, and profess fresh ideas.

Discovery universities are small in size and number. They are devoted to vigorous intellectual discovery through self-directed pedagogy and research. The discovery university relies heavily on autodidactic learning. It is a place of self-direction. The institutions of the library and the laboratory are at the heart of it. Compared with this, most contemporary universities offer a form of 'higher schooling.' The discovery university is defined not by the transmission of knowledge but by the adventurous finding of knowledge. Its first task is creation. Its second task is to prepare those who one day will do the same. Classically this is achieved by self-education supported by the superlative modelling of creative action.¹⁰ The auto-poietic archetype of learning is borne out by a century of studies of creative cohorts in the arts, sciences and the professions. Discovery is the apprehension of previously unobserved relations and forms. It manifests itself in learning, teaching, research, and innovation. While discovery is not identical to research, research typically accompanies discovery-based learning. The chief medium of both is the imagination. Research and discovery-based learning call upon similar capacities. Both require high levels of autonomy and both are marked by a strong propensity to objectivation, that is, the positing of intellectual and symbolic objects. These range from undergraduate research essays and reports through the graduate thesis to the book, artwork, model, exhibit, patent, and paper.

Through the post-industrial era, social engineering decimated the ecology and media of the imagination both in the universities and in the larger society. The

10 Albert Jay Nock, 1932: 73, observed: 'Let us speak of the university and the undergraduate college. Traditionally, the university was an association of scholars, grouped in four faculties Literature, Law, Theology and Medicine. When I say an association of scholars, I mean that it was not quite precisely what we understand by a teaching institution. The interest of the students was not the first interest of the institution. Putting it roughly, the scholars were busy about their own affairs, but because the Great Tradition had to be carried on from generation to generation, they allowed certain youngsters to hang about and pick up what they could; they lectured every now and then, and otherwise gave the students a lift when and as they thought fit. The point is that the whole burden of education lay on the student, not on the institution or on the individual scholar. Traditionally, also, the undergraduate college put the whole burden of education on the student. The curriculum was fixed, he might take it or leave it ... Moreover, he had to complete it pretty well on his own, there was no pressure of any kind upon an instructor to get him through it, or to assume any responsibility whatever for his progress, or to supply any adventitious interest in his pursuits. The instructor usually did make himself reasonably helpful, especially in the case of those whom he regarded as promising, but it was no part of the institution's intention or purpose that he should transfer any of the actual burden of education from the student's shoulders to his own, or contribute anything from his own fund of interest in his subject by way of making up for any deficiency of interest on the part of the student.'

consequence of this is that the kinds of eccentric, wide-ranging, free-wheeling, difficult and demanding intellectual modes, milieu and means—necessary for the brightest of the bright from all backgrounds to flourish—have diminished. In all but a handful of universities, these often-astringent intellectual methods have been replaced by the pedestrian media of the textbook, the unread weekly reading, and the content-starved power-point-driven lecture course. The latter deliver on fiercely audited political goals to increase social mobility and promote status-climbing by increasing ‘participation’ in higher education but these also marginalize and trivialize high-level intellectual formation and bore senseless the most intellectually-gifted students. In the end, a paradox is created. Everyone wants to have the glittering prize but to achieve that goal the glittering prize has to be destroyed.

There are a number of practical ways by which nations and universities can reverse this situation. The intent of proposing these is to overcome the tyranny of tedium that has been unleashed on the gifted, to find ways of re-birthing the media of the imagination at the heart of the university and in the wider society and restore a congenial place for adventurous minds. Rather than post-modern ‘participation,’ ‘access’ and ‘mobility,’ which have become tiresome clichés (rolled out by glib political actors) or worse still meritocratic dystopias (promoted by over-professionalized ghouls), there is a need today to think about pathways and destinations for the modest numbers of bright or highly-curious individuals, many of whom (in their student days) will fail exams, drop out, write papers that are out of their depth but for whom intellectual excitement and audacity matters, and who we know (from the evidence of very good studies) in the end will form a small but socially-essential cohort who are highly creative and who deliver virtually all of the lasting and transmittable achievements across the arts and sciences, in business and the professions.