Submission regarding "Boosting The Commercial Returns From Research"

Introduction

This submission summarises my ideas about the "responsible" commercialisation of university[1] research. That is how research, development or innovations processes and technologies embody societal values such as health and well-being, sustainability, safety and security, privacy, transparency and accountability. Currently there is a paradigm shift occurring in businesses around the world – social enterprises and corporate social responsibility (CSR) have been shown to attract customers, staff and investors. Business models are changing in response, as too the mechanisms through which companies engage with their supply chain and partners. For that reason, collaborating businesses and public research organisations will need to consider how their research commercialisation processes impact upon communities and the environment, and reflect contemporary community expectations.

Currently I am enrolled in a PhD program and the focus of my research is how universities engage with controversial industries. Over the past twenty years I have studied or worked at six universities in Australia, China and Hong Kong. I have visited many other universities and research organisations throughout Asia, Europe and Africa when employed in international relations and business development roles at a university and an Australian State government. The views expressed are purely my own and may not in any circumstances be regarded as stating an official position of any organisation.

Overview of Responsible Research and Innovation

Some of the efforts of universities to become embedded in the "knowledge economy" have launched them into complex and previously untested relationships with industry partners. Increased university-business cooperation brings with it the potential for the misalignment of expectations of values and behaviours deemed acceptable by staff, students, research users, community members and other stakeholders. For example, university stakeholders may disagree with the work practices and ideology of the industry partner, and I have frequently observed the misalignment of values and behaviours around human factors and the environment. There have been a number of studies of controversial university-business research collaborations including the nuclear (Andereggen, Vischer, & Boutellier, 2012), gambling (Cassidy, Loussouarn, & Pisac, 2014), asbestos (Ruff, 2014), pharmaceutical (Resnik & Elliott, 2013), and tobacco (Bero, 2005) industries. My colleague and I wrote about several controversies that arose from university-industry research partnerships in the realm

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[1] This submission refers to universities and public research organisations interchangeably.

of unconventional gas. (Hardie & Devetak Smith, 2014) Current efforts to expand university-industry engagement would benefit from cementing "responsible research and innovation" (RRI) values and behaviours into government policy and programs.

RRI describes a research, development or innovation process that considers the effects and potential impacts on the environment and society. One definition is "a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products in order to allow a proper embedding of scientific and technological advances in our society." (Owen et al, 2013) RRI asks at a fundamental level what research can do for society and who gets to make those decisions, which in turn obliges all participants in research and development (R&D) processes to be anticipatory, reflective, inclusive and responsive about their research, and subsequent commercialisation of the research. RRI was first introduced by the Dutch Research Council Program on Socially Responsible Innovations around 2006 and now is incorporated in the R&D agenda of the European Union. Although RRI emerged from Europe, it is a concept with true global purchase. The intensifying global debate regarding research integrity is incorporated in discussions about RRI. On 21 November, 2014 the Rome declaration on Responsible Research and Innovation policy was endorsed. The RRI approach is part of several European Framework Programmes and the continued development of a RRI Governance Framework means that researchers need to start considering the implications for their work.

A brief characterisation of Research Commercialisation in Australia

Governments and the public expect universities to play a larger role in regional economic growth. For example, Rothaermael et al (2007) provides a detailed analysis and synthesis of research on "university entrepreneurship" and Allen and O'Shea (2014) build upon the existing work by identifying the key factors and the contextual dynamic that drive "university entrepreneurship and innovation." The key findings for the second work that are relevant to the Australian context are:

1. Successful university technology commercialisation programs are long-term efforts as it may take years or decades to generate a positive return on investment (p355). The University of California, San Diego and Yale have been working for more than thirty years on technology commercialisation programs and some say that MIT has been successful in the arena since the beginning of the 1900s. Therefore government and university programs to encourage commercialisation of research should have long-term outlooks, and extend and expand upon the activities currently being undertaken in Australian universities.

2. There are many under-developed regional economic ecosystems in Australia. Consequently the opportunities for universities to play large roles in developing commercial partnerships differ markedly between localities.

3. Essentially universities need to partner with industry in order to identify and commercialise research. However, universities also have a related and important function to foster the entrepreneurial skills in staff and students, and provide formal incubation capabilities.

4. The major decisions to be made by traditional university commercialisation processes are the selection of the venture and forms of support that are needed. By contrast, the commercialisation of innovations developed jointly by university and industry partners can take a myriad of pathways, depending upon the motivations and resources of the partners at the time.

5. One successful strategy being pursued by universities is to build concentrations of research excellence or "steeples of excellence."[2] Star researchers are recruited to niche areas of the sciences and engineering drawing large volumes of funding. Having strong R&D funds and access to quality facilities means that star scientists can undertake curiosity-driven exploration that may eventually be relevant to industry. These scientific discoveries can form the basis for the establishment of effective new ventures. A different strategy employed by universities is to respond directly to key industrial concerns. Australia's universities need to be incentivised to become different from each other, so that they are able to better respond to local and international innovation "milieus."

By world standards, Australian universities are not perceived to be particularly innovative or entrepreneurial. Based upon the opinions of 61 of the world's Entrepreneurship and Innovation (E&I) experts with in-depth knowledge of university-based E&I ecosystems, the most highly regarded university-based entrepreneurial ecosystems are MIT, Stanford University and the University of Cambridge. The report entitled "Creating university-based entrepreneurial ecosystems evidence from emerging world leaders" by Graham (2014) in addition to identifying the three key players, closely examined an emerging group of leading E&I university-based ecosystems that operate in more challenging conditions. These institutions include Technion, Aalto University, University of Michigan, KAIST and the University of Auckland. The universities operated in challenging environments that were typically characterised as cultures that did not support E&I, geographic isolation and/or a lack of venture capital. (Graham, 2014,pii). The case studies of these institutions provide examples of successful mechanisms and processed implemented to stimulate and benefit from increased E&I. From what I've seen and read, the programs and projects work in one university at a point in time, do not necessarily work in another. The university resources

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[2] Fred Terman raised "steeples of excellence" in the School of Engineering as dean and throughout Stanford as provost and fostered the academic, industrial and governmental relationships that helped transform Stanford into a world-class university and the Silicon Valley region into an innovation hub.

and surrounding "milieus" stimulate E&I, which sometimes leads to commercial outcomes for students, staff, alumni and other intermediaries. Resources and regulations are part of the puzzle but culture, outlook, role models and locations also play a significant role.

Responsible Commercialisation of Research

With increased industry funding, the legitimacy, transparency and integrity of the research processes and results created by the Australian university system will be under scrutiny. Industry partners will need to be confident that Australian universities are capable of ensuring the quality their research, including mitigating the Environmental, Social and Governance (ESG) risks of the research process itself, as well as the commercial outputs. As universities find new channels and organisational forms to engage more closely with industry, the traditional roles of university research centres and technology transfer offices at some universities are merging and changing. It is challenging to locate which organisational unit and individuals are responsible for ensuring the CSR or University Social Responsibility (USR) or the RRI of research commercialisation processes.

The "problem of many hands" formulated by Thompson (1980) explains some of the risks inherent in the university R&D ecosystem.   Because many different people contribute to the policies and behaviours of an organisation, it is difficult to ascribe responsibility for the organisation's conduct to any individual. For outsiders, it is especially difficult to attribute responsibility.   As many different actors and institutions work together in complex cooperative projects to research and develop innovations, the non-hierarchical organisational structures increase the risk that certain aspects of "responsibility" will be overlooked or not carried out correctly because the participants expect someone else will do so. Current measures for enhancing the responsible commercialisation of university research are often caught between principles (doctrines and regulatory guidelines), practices (ordinary conduct and routines) and politics (political cycles).

To ensure the "responsible" nature of the Australian R&D ecosystem the following measures should be considered:

- ***Develop systematic approach to RRI in Australia.*** Policymakers in the European Union (EU) identified the causes that lead to an insufficient consideration of ethical aspects and societal needs in research and innovation a 2013 report Options for Strengthening Responsible Research and Innovation.   Incorporating their findings, Australian policymakers should consider how to develop an RRI framework that encompasses the entire R&D ecosystem.
- ***Implement a National Science and Technology Plan, incorporating existing State, regional and industry strategies.*** Many countries like the US, UK, the Asian Tiger economies and the European Union when looking to transform to a knowledge economy set out public plans to reach their goals for science and technology. In addition, they invest heavily in Science, Technology, Engineering and Maths (STEM) education at all

levels and entrepreneurial capacity building. The development of an explicit national strategy regarding science and technology will highlight areas with the potential support for economic and social development. It will also identify where there are constraints.

- ***Reframe the public debate about research commercialisation.*** To increase innovation and entrepreneurship, which in turns leads to improved productivity and capability to solve global challenges, the focus of government policy needs to move to a different place. The focus needs move from discussions about commercialisation, valorisation and translation of research to the role of government in fostering the bi-directional co-production of knowledge between universities and industry.

- ***Engage a broader public in devising, implementing and reviewing research programs.*** Echoing the structure of the [NHMRC Advisory Board](), national government agencies such the [ARC](), State level organisations and institutions should have more representation from outside the university. Another model would be to build a platform of civil society organisations striving for more transparency in the R&D ecosystem like the [Zivilgesellschaftliche Plattform ForschungsWende]() from Germany.

- ***Increase government policy and program focus to institutional-level responses to research integrity and RRI, rather than individual researchers.***   Research integrity frequently locates the problem at the level of the individual researcher rather than with the system that they are operating within. With increased engagement with industry, there are going to more levers and pressures on individual researchers to navigate the ethical minefields of industry-funded research. One part of a solution would be the appointment of a research regulator, as called for by [Professor Vaux in 2013]()

- ***Address the under representation of women in the research process.*** The gender dimension must be integrated in research and innovation processes from the human resources perspective, through to the research outputs.

- ***Support a Trans-Tasman platform to support Entrepreneurship and Innovation in universities.***   Almost all of the emerging university-based E&I ecosystems had adopted or adapted E&I activities from the top three institutions – MIT, Stanford and University. (Graham, 2014) However, despite the shared stimulus, most of the universities had not reached out to other emerging E&I universities, instead they struggle in isolation within their distinctive environments.   Australian universities could potentially benefit from a Trans-Tasman platform to support E&I in universities.

- ***Make Open Access happen.*** Open access to university intellectual property will stimulate innovation. Groups such as the [Australian Open Access Support Group]() support this and are amassing resources about the issues.

- ***Refocus Government procurement to stimulate innovation –*** Reshape current Government procurement policies to consider local innovative solutions to problems, and increase government agency R&D.

- ***Provide subsidies for Responsible Commercialisation of Research.*** Provide incentives for business enterprises to incorporate RRI into their business plans e.g. procurement initiatives and promotion of ethical venture capital and other funds.

- *Minimise red tape and change funding models.* As highlighted by John P.A. Ioannidis (2011) and others, scientists are judged by the amount of money they bring to their institutions. Writing, reviewing and administering grants absorb most of their time and effort. The low research projects acceptance rate therefore results in huge waste of time and resources. Government funds can then be used more productively across the entire R&D ecosystem.

- *Maintain or expand Government funding for basic research.* Do not underestimate the role of government funding of basic research. Over half of US economic growth has come from innovation with root in basic research funded by the federal government.

- *Government research funding strategies to target diversity rather than excellence.* [A quantitative study based on the data of the Research Council of Canada](quantitative study based on the data of the Research Council of Canada), shows a lack of correlation between grant size and citation impact suggesting therefore that larger grants do not lead to larger discoveries and that the most efficient funding strategies are those that target diversity, rather than excellence.

- *Randomise peer review process.*   The peer review process leads to systematic bias in favour of mainstream programs, and against minority research programs.   This in turns leads to the stifling of new ideas and innovation. (Gillies, 2014) For government funded research programs focussed on innovation there should be a randomised review process.

- *Reflect that foreign born staff and students engage with industry differently from local born in policy and programs.*   Libaers (2014) found foreign-born academic scientists in the United States have lower odds of having been approached by private firms to ask about their research activities, lower odds of having served as a paid consultant to firms, and lower odds of having been engaged in the joint transfer and commercialization of technologies with private firms relative to their local- born counterparts. In contrast, foreign-born academic scientists have significantly higher odds of having co-authored scientific articles with private firms than their U.S.-born counterparts. It would be useful to undertake a similar analysis in Australia given the large international student population and desire to engage closer ties with industry.

- *Support the development of industry-led research consortia and strategies*. Consortia like the Rural Research and Development Corporations or Australian Coal Industry's Research Program or the Construction Industry R&D Strategy could be relevant to other industries. There could be a role for government to mediate the organisations. There are also examples of models from overseas that could be considered, for example the Japanese polyvinyl chloride (PVC) recycling R&D group (Seki, 2014).

- *Fund innovation and entrepreneurship program focussed on students and alumni, rather than researchers.*   Research has shown that innovation frequently come from students and alumni, rather than employed researchers.   Harnessing the growing student entrepreneurial movement is imperative and embeds the university in the local economy. Direct funding to active Student Entrepreneurs Organisations could stimulate the commercial translation of university research.

Conclusion

Fundamentally, RRI is challenging because we don't know how the future will turn out. The delineation of roles and responsibilities between the government, institutions and individuals is increasingly unclear. Nevertheless government, universities and businesses are increasingly cognisant of their impact on people and the environment, and are employing CSR, USR and participatory methods to identify and mitigate future risks. The traditional linear model of government dispensing policies is in the process of being replaced by a virtuous circle based on networks, feedback and participation of stakeholders throughout the policy cycle (development through to deployment and evaluation). The RRI and "Research Integrity" movements are gaining traction in the research hubs of the United Kingdom, Europe and the US. Therefore, it is important that policymakers should embrace responsible research and innovation principles and practices when setting the agenda for the commercialisation of research in Australia.

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