Universities as facilitators of change:
The role of research in achieving the Sustainable Development Goals

Joanne Chong, Research Director, Institute for Sustainable Futures, University of Technology Sydney
Alison Atherton, Research Principal, Institute for Sustainable Futures, University of Technology Sydney
Caitlin Leahy, Research Consultant, Institute for Sustainable Futures, University of Technology Sydney
Stuart White, Director, Institute for Sustainable Futures, University of Technology Sydney

Joanne Chong, Research Director, Institute for Sustainable Futures, University of Technology Sydney (corresponding author)
    Joanne.Chong@uts.edu.au
    +61 401 074 704
    Level 11, Building 10, 235 Jones St
    Broadway NSW 2007 Australia

1. Introduction

Universities have critical and unique opportunities to contribute to the achievement of the Sustainable Development Goals (SDGs), through their core activities of research and education. In this paper we focus on the research dimension, and explore how universities can facilitate, advocate for and create change in society towards sustainable development.

This paper draws on our experiences at the Institute for Sustainable Futures, University of Technology Sydney, Australia (UTS:ISF); a transdisciplinary research institute with a mission to create change towards sustainable futures. As the Institute celebrates its 20th anniversary in 2017, we reflect on our evolving responses to the question, "How does research achieve sustainable development?" and the challenges and opportunities in conducting research, across faculties and disciplines, collaborating with other universities and partnering with a wide range of stakeholders across the globe.

Our examples of applied research cover three related domains. First, we explore transdisciplinary research in practice, integrating knowledge across disciplines and fostering partnerships beyond the university boundary to co-create and co-implement research. Second, we address the challenges such change-oriented research presents including to perceptions of the legitimacy and independence, on which our partnerships for sustainable development depend. Third, we highlight some of the characteristics inherent within the academic research sector that restrict researchers from orienting their efforts towards sustainable development, and outline a few examples of how universities can realistically reshape structures to recognise, encourage and reward such research.

Research, policy-maker and practitioner communities recognise that there are challenges in implementing and monitoring progress towards the SDGs. We outline a crucial "first step" to university implementation of the 2030 Agenda, a mapping exercise demonstrating how current research aligns with the SDGs. Reflecting on the contemporary opportunities and challenges facing the academic and development sectors, we then articulate three key, cross-cutting dimensions of the SDGs –

connectivity, complexity and inclusivity – as focus points for universities as they pursue research for sustainable development.

2. Universities are uniquely situated to foster change through research

In light of the worsening impacts of humankind's transgression of planetary boundaries, universities have been pointed to having a "moral obligation" to drive societal transformations towards sustainable development.[1] This obligation stems not only from the urgent need to address global crises, but also the unique characteristics of universities that afford the sector a powerful opportunity to facilitate societal change. Compared to government and corporate sectors, public universities are relatively independent from the short-term drivers of political cycles or shareholder returns. Although longevity and stability are by no means universal to all research positions, there are still opportunities for the sector as a whole to commit to the multi-year timeframes needed to foster long-term partnerships.[2] As such, universities can play a role not only in understanding and co-developing models for transitioning societies and economies, but also in learning from and participating in the implementation of these transitions in practice.

Universities are well situated to create new organisational models that incubate innovations and nurture partnerships for networking, co-developing and co-implementing research. "Living labs" for sustainability are just one such example where universities are developing arenas for collaborative experimentation. In these geographically-demarcated, stakeholder-inclusive spaces, researchers, citizens, business, governments and other stakeholders collaboratively develop, experiment and test new social interactions and new uses of technologies, products and services, in real-time, for sustainability outcomes.[3] There are also emerging examples of universities including their own extensive built infrastructure into the living lab,[4] including in some cases of active integration of the university campus with its surrounding community.[5]

Universities also have the opportunity to institute, facilitate or lead initiatives that enable voice and representativeness for communities and citizens, a core pathway for

---

[1] Johan Rockstrom et. al. 2009 cited in Alex Baker-Shelley, Annemarie van Zeijl-Rozema, Pim Martens, 'A conceptual synthesis of organisational transformation: How to diagnose, and navigate, pathways for sustainability at universities?', *Journal of Cleaner Production*, 145 (2017): 262-276.

[2] Carolyn Kagan et al. 'Sustainable Communities: University-Community Partnership Research on Social Dimensions of Sustainable Development', in *Sustainable Development Research at Universities in the United Kingdom : Approaches, Methods and Projects,* Walter Leal Filho (ed.) (Springer International Publishing, 2017), 245-262.

[3] Yuliya Voytenko, Kes McCormick, James Evans, Gabriele Schliwa, 'Urban living labs for sustainability and low carbon cities in Europe: towards a research agenda', *Journal of Cleaner Production*, 123(2016): 45-54.

[4] For example, the University of Technology Sydney's *Sustainable Sanitation Project* piloted urine diversion (UD) recovery and reuse systems within the institutional setting of the university campus, to inform ways to scale-up radically different forms of sanitation. Cynthia Mitchell, Dena Fam and Kumudini C. Abeysuriya, 'Transitioning to sustainable sanitation: a transdisciplinary pilot project of urine diversion'. (Sydney: ISF-UTS, 2013).

[5] For example, UC Davis' West Village, a partnership between the university and the private sector, is planned to the largest planned "zero net energy" community in the United States. The project will include commercial space, residential housing, student facilities, as well as community facilities. See UC Davis, 'UC Davis West Village; About West Village', accessed August 3, 2017. http://westvillage.ucdavis.edu

attainment of the SDGs.[6] For example, universities are advancing knowledge about deliberative democracy through actively facilitating platforms for its implementation.[7] A widely known example is the Danish Board of Technology's initiation in 2009 of the first-ever global citizens' consultation on climate change, *World Wide Views on Global Warming*. The project empowered citizens from 38 nations to voice their preferences for international policy and action on climate change. UTS was one of 16 universities globally to lead the process within their country; since then events have been held on biodiversity, oceans and seas[8]. Community engagement practitioners and researchers are also collaborating to tailor new futures[9] and visioning processes to involve the public and other stakeholders in goal-setting, back-casting and the development of transitions pathways for sectors such as water,[10] energy and mining.

There is also potential for academics to foster cross-sectoral partnerships and networks by embedding themselves within other organisations. Beyond the traditional sabbaticals and fellowships at other academic institutions, there are growing examples of researcher secondments to industry or government, and vice-versa. The appointment of professors or senior researchers on a part- or full-time basis to lead government, environmental and sustainability-related public inquiries, major programmes of reform, and public agencies, is another key avenue for universities to collaborate for sustainable development. Another, project-level potential for embedding is researchers conducting evaluations of publicly-funded projects in the social service sector or aid-funded international development projects. The 'developmental evaluation' model is one in which researchers are integrated within the project delivery team. Through long-term partnerships sustained over the course of implementation, researchers support continuous learning and innovation. This model is particularly relevant in complex and uncertain situations where the project might need to change and adapt according to emerging and changing contexts, such as those relating to climate change.[11]

Universities have the capacity engaging and connect across society, on ideas, knowledge and practices. Their researchers thus hold a prescient responsibility to transform themselves beyond a role of "impartial" knowledge providers to that of active change agents. The role of "researcher-as-change-agent" is not, however, without its challenges and conflicts, as discussed in the following sections.

3. Transdisciplinary research: integration and partnership learnings

[6] United Nations, 'Information for integrated Decision-Making & Participation', *Sustainable Development Knowledge Platform*, accessed August 3, 2017. https://sustainabledevelopment.un.org/topics/information-integrated-decision-making-and-participation

[7] For example: by Richard Worthington, Mikko Rask and Lammi Minna (eds.) *Citizen Participation in Global Environmental Governance*, (Earthscan, London, 2012).

[8] There have been two subsequent World Wide Views events, on biodiversity and climate and energy. In the most recent event, 10,000 people from 76 countries participated, including many developing nations. A further process on oceans and seas is in progress with the explicit goal "to ensure that lay citizens are also included in making decisions about how to implement SDG 14"
World Wide Views, 'Worldwide Views on Climate and Energy, June 6 2015' accessed August 3, 2017. http://climateandenergy.wwviews.org/national-and-regional-partners/

[9] Sohail Inayatullah, 'Six pillars: futures thinking for transforming.' *Foresight*, 10:1 (2008) 4-21.

[10] Joanne Chong, Keren Winterford, Aleta Lederwasch, 'Commmunity Engagement on Water Futures: Using Creative Processes, Appreciative Inquiry and Art to bring Communities' Views to Life.' *Ozwater2017*, Confeerence of the Australian Water Association, 16-18 May 2017, Sydney.

[11] Joanne Chong, Pia Treichel and Anna Gero, 'Evaluating Climate Change Adaptation in Practice: A Child-Centred, Community-Based Project in the Philippines', in *Evaluating Climate Change Action for Sustainable Development*, Juha I. Uitto, Jyotsna Puri, Rob D. van den Berg (eds.), (Springer Open, 2017), 289-304.

Transdisciplinarity has emerged as a powerful way to catalyse and shape the transformations needed to confront the complex sustainable challenges facing humanity. The definitions of "transdisciplinary research" are not strictly bounded, but in relation to sustainable development outcomes, most coalesce around three key conceptual and practice characteristics. Firstly, transdisciplinary research integrates and transgresses beyond individual epistemologies, knowledge and practices.[12] With the whole being both more than and *different* to the sum of its parts, transdisciplinarity draws on and synthesises from multiple disciplines, knowledge and practice areas, to creatively develop *new* theories, concepts and methods that extend beyond the limits of the singular areas on which it builds. In practice this means working in partnership with researchers from a myriad of disciplines. Secondly, transdisciplinary research, transcends the conventional knowledge production-transfer boundaries, between researcher as investigator, participant as subject, and stakeholder as beneficiary. [13] Transdisciplinarity thus requires partnerships between academics and non-academics, to collaboratively co-identify, co-develop and co-implement research. Thirdly, it is purposive,[14] in its deliberative and normative pursuit of problem solving, change and solution creation, particularly relevant to uncertain situations and "wicked problems".

There is a growing body of work by researchers documenting the approaches and methods for pursuing transdisciplinary, integrative inquiry. Systems thinking and complexity science have, for example, emerged as two related although at times competing conceptual approaches to tackling the sustainability challenges, with an emphasis on considering the connections between the parts in the whole. [15] Transdisciplinary researchers have developed, tested and are collating frameworks and tools to guide transdisciplinary research, including to synthesise disciplinary and stakeholder knowledge, understand and manage diverse "unknowns", and pursue policy and practice change.[16] Many of these tools also attempt to address what is arguably one of the most fundamental challenges of transdisciplinary research – the inherent and often substantial difficulty of specialists and practitioners from one discipline, to understand the ideas, concepts and methods of another.[17] These challenges need to be overcome in order to achieve the integration and create the new praxis (theory-informed practices) required for sustainable development.

UTS:ISF's transdisciplinary research extends beyond integration of "close disciplinary neighbours" such as within the physical sciences, or within the social sciences. In many

---

[12] John Robinson, 'Being undisciplined: Transgressions and intersections in academia and beyond.' *Futures*, 40 (2008): 70-86.

[13] Roderick J. Lawrence, 'Beyond Disciplinary Confinement to Imaginative Transdisciplinarity', in *Human Experience in the Natural and Built Environment: Implications for Research, Policy and Practice*, IAPS 22 Conference, Abstracts of Presentations. (IAPS, 2012).

[14] Erich Janstch, 'Inter- and transdisciplinary university: A systems approach to education and innovation', *Higher Education*, 1(February 1972): 7–37.

[15] Pascal Perez and David Batten (Eds.), *Complex Science for a Complex World Exploring Human Ecosystems with Agents*, (Australian National University E Press, Canberra, Australia, 2003)

[16] Cynthia Mitchell, Dana Cordell and Dena Fam, 'Beginning at the end: the outcome spaces framework to guide purposive transdisciplinary research' , in *Transdisciplinary Research and Practice for Sustainability Outcomes,* Dena Fam, et. al., eds., (Oxon: Routledge, 2017), 25-39.
Gabriele Bammer, 'Tools for transdisciplinary research' in *Transdisciplinary Research and Practice for Sustainability Outcomes,* Dena Fam, et. al., eds., (Oxon: Routledge, 2017), 39-55.

[17] Peter B. Checkland, 'Science and the systems paradigm' 1976, cited in Ray Ison, 'Transdisciplinarity as transformation: a cybersystemic thinking in practice perspective', *Transdisciplinary Research and Practice for Sustainability Outcomes,* Dena Fam, et. al., eds., (Oxon: Routledge, 2017), 55- 75.

of our projects, we confront the remarkable challenge of drawing from fundamentally diametric paradigms, epistemologies, practices, and the associated values and worldviews of the individual researchers. We attempt to integrate from across the humanities, social science, science, technology, engineering, and economics fields. The differences between the positive and quantitative-oriented paradigms, and the interpretative and qualitative-oriented paradigms, are both countless and profound. These include different views on the nature, generalisability and purpose of knowledge, conceptualisation of reality, and what constitutes legitimate research design and methods.

Whilst many of our researchers have multiple disciplinary backgrounds, we often also partner with researchers and practitioners from more traditionally singular disciplines. In one recent example, the *Alaskan Water and Sewer Challenge*, the team comprised five members: one microbiologist with practice expertise in the indigenous health and public health sector; two engineers who had designed decentralised water and sanitation systems in the Arctic, one design consultant with a background in chemical engineering, and one with a background in industrial design. Whilst all team members were committed to the need for community engagement and social research, there emerged a distinct delineation in the team between positivist and interpretivist paradigms, in terms of the nature and purpose of knowledge, and hence how and to what extent social research and the community's perspectives, experiences and capabilities should inform the design. The imperative was to *translate* knowledge across boundaries. Techniques employed by the social design team members included visualising, through diagrams, not only the technical system, but the socio-technical system and linguistic interpretation, by adapting terminology from one discipline (such as "technology prototyping") to describe approaches from another discipline ("management prototyping").[18]

Traditional models of risk analysis are no longer sufficient to address global or local sustainability challenges. There is a need for disciplines to focus on pathways and transitions, not just current state or end-points, and for methods and practices to address system flexibility, adaptability and resilience. In response, transitions research has emerged as a core transdisciplinary area for sustainable development. It spans multiple systems-thinking based approaches,[19] including socio-technical approaches, such as those addressing the entry and take-up of new, radically system-changing, sustainable technologies into society;[20] socio-institutional approaches, such as understanding the political and institutional context for energy transitions[21] and socio-ecological transitions, such as supporting communities dependent on natural resources to increase their resilience to climate change.[22] With countless issues emerging, sustainable

[18] Dena Fam and Zoe Sofoulis, 'Trouble at the disciplinary divide: a knowledge ecologies analysis of a co-design project with native Alaskan communities, in *Transdisciplinary Research and Practice for Sustainability Outcomes,* Dena Fam, et. al., eds., (Oxon: Routledge, 2017), 236-253.

[19] Derk Loorbach, Niki Frantzeskaki, and Flor Avelino, 'Sustainability Transitions Research: Transforming Science and Practice for Societal Change', *Annual Review of Environment and Resources*, 42(2017):4.1-4.28

[20] Dena Fam, 'Facilitating communities of practice as social learning systems: a case study of trialling sustainable sanitation at the University of Technology Sydney (UTS)', *Knowledge Management Research and Practice*, (Springer Open), 1-9, 2017.

[21] Chris Riedy, Alison Atherton and Jenni Downes, 'Market Transformation for Energy Efficiency: Stage 2 Report.' (Sydney: ISF-UTS, 2016). This project applied transition management theory and multi-level perspective analysis to map transition pathways for the energy efficiency sector in NSW.

[22] Jeremy Kohlitz, Joanne Chong, Juliet Willetts (forthcoming). 'Resilience or vulnerability? Community managed water services in Vanuatu'

development researchers face the tension between remaining open to incorporating new challenges and drawing boundaries to enable participants to engage in transdisciplinary dialogue.[23]

Sustainable Development Goal 17, Target 16 calls for us to "Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries." The SDSN has articulated that a core action area for the field of science is to develop new partnerships between academics, civil society, businesses and governments.[24] We have particular reflections on partnerships from UTS:ISF's international development research programme, particularly from our practice-based research in the field of monitoring and evaluation. We draw on the principles of developmental evaluation[25] to co-design and co-implement processes with NGOs, donors and governments to generate and embed knowledge and learning within the course, or for the design, of international development programmes. For example, UTS:ISF has worked in collaboration with several Australian and international NGOs in the WASH and gender sectors[26], and used strengths-based and qualitative research approaches in the Pacific (Fiji and Vanuatu)[27] and South East Asia (Vietnam) to develop and implement a framework for documenting and assessing gender equality outcomes in WASH programs[28] (SDGs 5 and 6).

In one recent instance ISF partnered with Plan International and Centre for Natural Resources and Environmental Studies (CRES) at the Vietnam National University to examine the impact of Plan's gender and WASH monitoring tool, specifically in meeting strategic gender outcomes that move beyond practical changes in roles and relationships between women and men, to those that indicate a shift in power relations towards increasing gender equality (SDGs 5 and 6). The research need, concept, hypothesis and methods were co-designed by the NGO and the researchers. The key factors enabling partnership were: existing strong relationships, clarity of role definition, and openness and flexibility to changing circumstances. They main challenges and constraints were limited timeframe and resources, and the need for partners to "cede" areas of decision-making authority to each other when each were accustomed to taking the lead on research.[29]

Co-design and co-implementation are core tenets of transdisciplinary research for sustainable development. In practice, there are significant challenges. UTS:ISF has developed the following set of four principles, in addition to transdisciplinarity, that are

[23] Loorbach, "Sustainability Transitions Research", 4.1 - 4.28

[24] Dr. Bettina Schmalzbauer and German Committee Future Earth Secretariat, 'The Contribution of Science in Implementing the Sustainable Development Goals', (Stuttgart: German Committee Future Earth, 2016).

[25] Michael Quinn Patton, *Developmental Evaluation: Applying Complexity Concepts to Enhance Innovation and Use.* (New York: The Guildford Press, 2011).

[26] Plan International Australia, Plan International Vietnam, East Meets West Foundation, International Women's Development Agency, World Vision and Live & Learn.

[27] Juliet Willetts et. al. 'Working from strengths to assess changes in gender equality, *Development in Practice*, 23(2013): 991–1006.

[28] Naomi Carrard et. al. 'A framework for exploring gender equality outcomes from WASH programmes ', *Waterlines: international journal of water, sanitation and waste*, (32:2013): 315-333.

[29] Caitlin Leahy et. al., 'Research collaboration for impact evaluation: Case of a gender and wash study in central Vietnam', *Development Bulletin*, 79(2017) (forthcoming)

particularly useful to gain partner commitment to guide partnerships for impact.[30] These are:

1) Letting go of tight control of the process and co-designing research in a way that gives equal space for perspectives from across disciplines, sectors and cultures means complex problems can be tackled more effectively. This often involves taking risks which balance rigour and merit with relevance to the research context.

2) Upholding ethics is important to manage the moral and political issues and dilemmas posed by research into complex problems. Ethical practice applies to the relationship between different partners, not just to researcher/participant relationships. As stated by the Australian Council for International Development, ethical principles include respect for human beings; justice; merit and integrity and beneficence.[31]

3) Building in research translation relates to researchers' responsibility to propose practical, implementable solutions and communicate these to society effectively. Knowledge needs to be a global public good in order to address issues of inequity and social justice worldwide. Research needs to be 'translated' into a variety of languages, formats and styles to be relevant to society and used beyond academia.

4) Willingness to go beyond evaluation means pushing the boundaries of evaluation in ways that help us to gain knowledge, understanding and insight above and beyond the need to audit and assess programs. Lessons and learning can be shared broadly and can contribute to improving policy and practice.

Partnerships that follow these principles are more likely to be transformative, with greater capacity to address complex problems posed under the SDG framework in a way that leads to genuine change and positive outcomes for societies and communities.

4. University research: navigating the pathways to advocacy and change
In considering the "moral obligation" of universities to drive societal transformations towards sustainable development, researchers conceivably hold roles as active change agents. It could be envisaged that the role of university research sits on a blended spectrum ranging from, at one end, 'pure', disciplinary, knowledge creation and discovery, to, at the other end, research conducted to inform specific 'advocacy' causes. It might seem that research at the latter end of the spectrum can play a more active role in achieving the SDGs than the former, but all research has the potential to lead to change, intentional or otherwise; and all research outcomes have the potential to be used by others, particularly governments, to support a change agenda.

As universities seek diverse funding sources for sustainable development research partnerships, their research independence may come into question. However, given that all funders have agendas (whether explicit or implicit), the direction if not the approach to

---

[30] Keren Winterford, Anna Gero, Caitlin Leahy and Janina Murta, 'Beyond partnerships as a process - Designing research partnerships for impact and change', material presented at the 'Beyond partnerships as a process - Designing research partnerships for impact and change' workshop, Research for Development Impact Conference, Sydney, June 13, 2017.

[31] Australian Council for International Development, 'Principles and Guidelines for ethical research and evaluation in development.' (Canberra: ACFID, 2017)
https://acfid.asn.au/sites/site.acfid/files/resource_document/ACFID_RDI%20Principles%20and%20Guidelines%20for%20ethical%20research12-07-2017.pdf

research is commonly influenced at least in part by the funder. Researchers are already far from immune to the vagaries of funding availability, as researchers in countries whose governments have cut climate change and environmental science funding are well aware.[32] Universities, individually or perhaps more powerfully, collectively, can actively influence the research agendas of funders. They also confront challenges in this regard when pursuing the SDGs, when principles of social change and academic freedom come into conflict with each other.[33] Even if it was desirable, the potential for "negative screening" of research opportunities on the basis of negative social or environmental impact, in relation to the SDGs may be a considerable challenge in funding-constrained environments.

Research to support societal change can be controversial, especially where it challenges established norms and threatens power structures, paradigms and entrenched interests. At one extreme, climate change scientists have faced threats to their own personal safety;[34] climate scientists increasingly occupying a space that many find uncomfortable, but necessary, of advocating for action on climate change.[35] Others working in areas articulating resource scarcity have faced deliberate campaigns to undermine their credibility by those with vested interests in resource consumption. Conventional and "risk-averse" modes of infrastructure provision, such as billion-dollar services in water, energy and transport, are challenged by large-scale uncertainties such as climate change, requiring new and at times politically unwelcome changes to status-quo approaches.[36] By extension, pursuing research for sustainable development can in this way also result in criticisms of the fundamental legitimacy of entire teams or organisations. Working with a range of external partners to moderate these potential

[32] The Commonwealth Scientific and Industrial Research Organisation (CSIRO), the federal government agency for scientific research in Australia, has suffered substantial cuts in recent years to its climate change science research programs, to align with the de-prioritisation of climate change at the national policy level. See Chris Turney "CSIRO cuts: as redundancies are announced, the real cost is revealed", *The Conversation*, May 26, 2016, https://theconversation.com/csiro-cuts-as-redundancies-are-announced-the-real-cost-is-revealed-59895 and Peter Hannam, 'Climate science to be gutted as CSIRO', *The Sydney Morning Herald*, February 4, 2016, http://www.smh.com.au/environment/climate-change/climate-will-be-all-gone-as-csiro-swings-jobs-axe-scientists-say-20160203-gml7jy.html
In the USA, the first budget proposed under the Trump Administration also signalled major cut backs, particularly for the Environmental Protection Agency (EPA). See Emily Demarco, 'Trump's proposed 2018 budget takes an ax to science research funding', *Science News*, May 26, 2017. https://www.sciencenews.org/blog/science-public/trump-proposed-budget-science-research-funding
[33] One example is the ultimately unsuccessful attempt by the Australian government to establish a research centre headed by "skeptical environmentalist" Bjorn Lomborg. Australian universities that were considering or had agreed to host the centre faced backlash from staff and the broader community which eventually led to the idea being dropped by government. Whilst universities arguably "should be places for contesting controversial issues without fear or favour," this case is illustrative of the challenges facing universities when pursuing the SDGs when principles of social change and academic freedom come into conflict with each other. See Matthew Knott, 'Bjorn Lomborg research centre dropped by Turnbull government: Simon Birmingham', *The Sydney Morning Herald*, October 21, 2015. http://www.smh.com.au/federal-politics/political-news/bjorn-lomborg-climate-centre-dropped-by-turnbull-government-simon-birmingham-20151021-gkek0s.html
[34] One such report appeared in the Guardian in February. See Oliver Milman, 'Climate scientists face harassment, threats and fears of 'McCarthyist attacks'', *The Guardian*, 23 February 2017. https://www.theguardian.com/environment/2017/feb/22/climate-change-science-attacks-threats-trump
[35] Michael Nelson and John Vucetich, 'On Advocacy by Environmental Scientists: What, Whether, Why, and How' *Conservation Biology*, 23, 5(2009): 1090–1101.
Noel Castree, et al., 'Changing the intellectual climate', *Nature Climate Change*; 4(2014): 763-768.
[36] Joanne Chong and Stuart White, 'Urban—Major Reforms in Urban Water Policy and Management in Major Australian Cities' in Barry Hart and Jane Doolan, eds., *Decision Making in Water Resources Policy and Management*, (Elsevier, 2017), 85-96.

impacts is core to our approach at UTS:ISF. In our research we involve stakeholders holding multiple perspectives and aim to build long-term, networked partnerships, to ensure a participatory approach to research and ensure credibility. This is particularly true of our research in the Australian energy sector, supporting transitions to a low carbon energy system. In recent large, multi-year research projects on the Australian energy market[37] we have directly engaged project partners from government, energy businesses (vested interests and new market entrants) and consumers, to ensure that different stakeholders are not only heard through the research, but are actively involved in co-designing elements of the projects to ensure that the outcomes have broad acceptance.

For those at the deliberate end of the change spectrum, researchers are increasingly criticised for failing to maintain "neutrality". For example, when pursuing research that addresses the needs of the marginalised and vulnerable, exposes breaches of human rights, or ultimately questions international or domestic policies that lead to inequality and harm, researchers can find themselves as failing to maintain an apolitical stance. The response to climate change, for example, is a highly politicized issue in Australia and at least in some sectors, any research undertaken on climate change response can be seen as 'political.' This reaffirms the importance of involving diverse stakeholders in this work.

Transdisciplinarity has gone some way to challenging the influential idea of science and research as completely value-free, neutral inquiry. Further, critical awareness, reflexivity and the ability to question and be aware of the influence of values and worldviews on research, are essential attributes for transdisciplinary research[38] and the analysis of sustainability problems. [39] However, the tension between reflexivity and reliability has not been resolved. Constructs of validity differ substantially along epistemological and ontological lines, there can also be significant tensions within an individual field as to whether the best way for researchers to influence sustainable development should be to remain "objective observers" or "engage actively" with other stakeholders.[40]

As the SDGs make explicit, societal change is a long-term endeavour. For universities, this means a willingness to embrace uncertainty and the complexity of long-term partnerships. At UTS:ISF, the time from research results to policy change can in many cases extend beyond a decade. The relationships we form with key government partners during research processes – both at individual and agency level – are core to our ability to influence policy change.[41] This demonstrates the challenging need to track

[37] For example, Jay Rutovitz, et. al., 'Virtual trials of Local Network Charges and Local Electricity Trading: Summary Report.' (Sydney: ISF-UTS, 2016). This project brought together a partnership of consumers, researchers, electricity providers and government to research two electricity market mechanisms to support local energy

[38] Dena Fam, Tanzi Smith and Dana Cordell, 'Being a transdisciplinary researcher: skills and dispositions fostering competence in transdisciplinary research and practice' in *Transdisciplinary Research and Practice for Sustainability Outcomes,* Dena Fam, et. al., eds., (Oxon: Routledge, 2017), 77-93.

[39] Florin Popa, Mathieu Guillermin, Tom Dedeurwaerdere, 'A pragmatist approach to transdisciplinarity in sustainability research: From complex systems theory to reflexive science', *Futures*, 65(2015): 45-56.

[40] Walter Leal Filho, ed. *Sustainable Development Research at Universities in the United Kingdom : Approaches, Methods and Projects,* (Springer International Publishing, 2017).

[41] Stuart White, Anastasia O'Rourke, and Emma Aisbett, 'Extending the Responsibility: Packaging and the Beverage Industry', paper presented at the 11th International Conference of Greening of Industry Network San Francisco, October 12-15, 2003.

the influence of research on societal change over long time periods, and maintain partnerships beyond the end of project timelines.

5. Incentives and recognition

Whilst universities have the capacity to innovate, we cannot deny that many sectoral attributes inhibit those researchers striving to create real-world change by integrating disciplines across epistemological, pragmatic, normative and purposive levels.[42] Organisational structures in universities, and the incentives facing researchers seeking to build fulfilling and secure careers, predominantly favour individual, disciplinary research, and can undervalue the real-world, change creation outcomes of transdisciplinary research. Other limiting characteristics include: the traditional emphasis on recognising individual rather than collaborative or team achievement; the scarcity of well-established transdisciplinary, sustainable development journals and the difficulty (due to the inherently multi-subject nature of transdisciplinarity) for these to achieve high impact; and academic promotion and career advancement criteria that fail to appropriately acknowledge societal problem solving.[43]

Pursuing the SDGs through research has structural implications for universities. The co-location of researchers from a range of disciplinary backgrounds in the same department and same physical workspace is an important, although still uncommon, institutional structure to foster collaboration and development of plural ideas and approaches. UTS: ISF was explicitly established as a transdisciplinary research institute, with a very deliberate decision in 1996 to create a "real" rather than a virtual unit, with all researchers' co-located in the same floorspace. In contrast, many other research institutes have described their organisational evolution as one from a "virtual" unit comprising individual researchers based at various different faculties, to eventually securing the floorspace to achieving co-location of these researchers.[44]

The ability of a sustainable development institute to conduct transdisciplinary research arguably increases when it is established as a unit reporting to the Provost or Research executive rather than located within a single faculty, but this creates other challenges. As noted in a review of sustainable development research in UK universities, there is a lack of central funding for sustainable development research institutions and as a result they

---

In 2002/3, ISF conducted an Independent Review of CDL in New South Wales to assess the environmental, financial and social costs and benefits to the community and industry that would result from such legislation. Although the review concluded that a total benefit to society would follow the introduction of a best practice form of CDL in New South Wales it was followed by a long period of inaction on the issue. A Container Deposit Scheme passed the NSW Parliament over a decade later, in October 2016. In announcing the scheme, the then NSW Environment Minister cited the ISF review as a seminal piece of work in development of the CDL. For many years following the review, it seemed as though the research had achieved little impact. In fact, it appears, at least anecdotally, that it played an important role in the eventual implementation of CDL in NSW.

[42] Erich Jantsch. 'Towards interdisciplinarity and transdisciplinarity in education and innovation' in *Interdisciplinarity: problems of teaching and research in universities,* edited by Apostel L Berger G. Briggs A. and Michaud G. eds. (Paris: OECD, 1972) 97-121.

[43] Idil Gaziulusoy, 'Identifying and addressing challenges faced by transdisciplinary research teams in climate change research', *Journal of Cleaner Production*, 123(2016): 55-64.

[44] Carlos Mataix et. al., 'Working for Sustainability Transformation in an Academic Environment: The Case of itdUPM', in *Sustainable Development Research at Universities in the United Kingdom: Approaches, Methods and Projects,* Walter Leal Filho, ed. (Springer International Publishing, 2017).

are less likely to operate in a continuous way.[45] A review of interdisciplinary sustainability institutes in the USA found that they can be "provocative as some perceive them to be competing for resources, most notably money and students."[46] At UTS:ISF we have addressed these two challenges through firstly, a predominantly self-funded business model with a wide, diverse funding base; and secondly, making connections with researchers in other disciplinary areas.

Structures that adversely affect promotion and career development opportunities are of major concern to transdisciplinary researchers. At UTS, research income from non-traditional sources such as industry and government are considered as a proxy indicator of valuable research partnerships. This is fortunate for our researchers in terms of career progression opportunities especially given that in the Australian context, we experienced a period of decline of public research funding for sustainable development, particularly climate change-related activities. Overall, whilst societal engagement and impact achievements are highly regarded by academic progression panels, it is an ongoing process to establish standards which recognise these achievements as more than "additional extras".

Sustainable development researchers have an important role to actively influence methods and approaches to measure impact.[47] Evaluating transdisciplinary research is both complex and contested, and in line with the complexity of monitoring progress towards the SDGs and associated targets, the monitoring and assessment of research contribution towards these outcomes is also complex. What is clear is that conventional publishing metrics are insufficient and create problematic incentives. UTS:ISF is currently contributing to the Australian Research Council's pilot for *Engagement and Impact Assessment* [48] including to offer examples of impact metrics covering environmental outcomes (e.g. litres of water saved), social outcomes (e.g. support for vulnerable groups), and importantly, process and institutional outcomes (policy, regulatory or legislative changes).

UTS:ISF has translated principles for transdisciplinary research quality into specific guidance for students, supervisors and assessors involved in its postdoctoral programme. This guidance was based on a critical literature review of transdisciplinary research and doctoral assessment(including on disciplinary fields) and experience and practice from our own transdisciplinary higher degree research program.[49] The criteria are:

---

[45] Walter Leal Filho, 'Sustainable Development Research at Universities in the United Kingdom: Moving Forward', in *Sustainable Development Research at Universities in the United Kingdom : Approaches, Methods and Projects*, Walter Leal Filho, ed., (Springer International Publishing, 2017), 373-379.

[46] Andrew Hoffman and Jessica Axson, 'Examining Interdisciplinary Sustainability Institutes at Major Research Universities: Innovations in Cross- Campus and Cross-Disciplinary Models' *Working Paper No. 1366*, (Ann Arbor, MI: University of Michigan, 2017).

[47] Gary Kass, Ben Shaw and Fred Steward, 'The UK Sustainable Development Research Network—Bridging the Sustainability Science/Policy Divide', in *Sustainable Development Research at Universities in the United Kingdom : Approaches, Methods and Projects*, Walter Leal Filho, ed., (Springer International Publishing, 2017), 279-294.

[48] Australian Research Council, 'Engagement and impact assessment consultation paper'. Accessed August 8, 2017. http://www.arc.gov.au/engagement-and-impact-assessment

[49] Juliet Willetts and Cynthia Mitchell, 'Assessing transdisciplinary doctoral research: quality criteria and implications for the examination process' in *Transdisciplinary Research and Practice for Sustainability Outcomes,* Dena Fam, et. al., eds., (Oxon: Routledge, 2017), 122-137.

- Criteria 1: Substantial research that makes an original contribution to knowledge and other broader societal outcomes
- Criteria 2: Demonstrated reflexivity and responsiveness
- Criteria 3: Research integrity as demonstrated by credibility, legitimacy, alignment
- Criteria 4: Appropriate breadth and depth of engagement with both research context and literature
- Criteria 5: Coherent argument across diverse conceptual and methodological approaches and perspectives

These criteria nevertheless leave the program with a quandary, reflecting the relatively new and integrative status of transdisciplinary research – that there is only a small pool of experienced transdisciplinary examiners.

6. First step, and a proposal for the next steps

Universities in the Australia/Pacific Sustainable Development Solutions Network (SDSN) are starting to experiment with approaches to mapping their current research activities to the SDGs.[50] As a first step, mapping helps universities identify key internal champions, and can also help build the internal business and strategic cases for further SDG engagement university-wide.[51] UTS:ISF recently undertook such a mapping process.[52] The mapping was facilitated by a small project team, working and communicating predominantly with the heads of our ten research areas. A data entry tool was prepared and used by the researchers themselves or used in interviews with the researchers to complete the mapping. A collaborative approach was taken to briefing and working with all researchers involved, and several reported gaining a stronger understanding, through the mapping process, of SDGs and their potential role in meeting them. The exercise was designed to be time-intensive on the part of the mapping team, but requiring relatively limited effort by the researchers providing information. Common approaches used by other institutions include key word searches of course descriptions, research project summaries online, abstracts, and media, matching to research classification codes[53], and interviews with key personnel. From these early experiences, it is evident that the success of all mapping processes relies on leadership support for the initiative at Dean and executive level. It is also important to combine quantitative and qualitative data and ideally, to use participatory approaches which, although time consuming, serve to gain buy-in to the 2030 Agenda from researchers and University personnel.

Beyond a mapping exercise, we appreciate there is no universal recipe for individuals, teams, schools, faculties and universities seeking to facilitate change towards the SDGs. The specifics of transformation *within* a university will depend very much on the starting points and opportunities revealed through the organisational mapping process. Whilst

---

[50] See for example: SDSN Australia/Pacific and ACTS, *Mapping University contributions to the SDGs* (Webinar, 1 May 2017). Retrieved from https://youtu.be/PbET71egLzw.

[51] Tahl Kestin et. al., 'Getting started with the SDGs in universities: A guide for universities, higher education institutions, and the academic sector', (Melbourne: Sustainable Development Solutions Network (SDSN) – Australia/Pacific in collaboration with the Australasian Campuses Towards Sustainability (ACTS) and the global SDSN Secretariat, 2017, *forthcoming)*

[52] ISF-UTS, 'SDGs: Mapping our research', accessed August 7, 2017. http://www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/our-research/sdgs-mapping-our

[53] Under the Australian and New Zealand Standard Research Classification (ANZSRC) there are three research classifications used by Universities to measure and analyse their research work; Type of Activity (TOA); Fields of Research (FOR) and Socio-economic Objective (SEO) which help to measure and analyse research. See http://www.arc.gov.au/rfcd-seo-and-anzsic-codes

some goals are universal (e.g. SDG 1, No Poverty), some disciplinary areas may identify more directly with certain individual goals (such as SDG 3 Health, SDG 4 Education). At a university level, an important value of the SDGs as a framework for researchers lies in taking the next step, beyond alignment with individual goals, to understanding how research could strengthen the linkages *between* SDGs, in line with the emphasis on integration between SDGs under the current agenda.[54]

To do this, we propose that focusing on the following three dimensions of sustainable development, that are cross-cutting across SDGs, will assist in guiding, organising and implementing activity and strategy:

- *Connectivity* – The SDGs explicitly address interactions within and between environmental, economic, financial, social, legal and political systems. The implication for research is that it is critical to integrate knowledge across disparate disciplines.

- *Complexity* – Due to the uncertain, dynamic, non-linear nature of the above systems, global sustainable development challenges have the characteristics of "wicked problems." The implication for research is that dedicated spaces, and a culture of learning, experimenting and evaluating is needed.

- *Inclusivity* – Social equity and social justice are at the core of the SDGs. There is an opportunity for researchers across disciplines to understand and embrace concepts of voice, representativeness, participatory democracy and indigenous knowledge. Truly collaborative research activity with multiple sectors beyond academia poses deep challenges, but is required to implement the SDGs.

Universities will need to undergo numerous organisational transformations to increase their research contributions towards the SDGs, and not all of these will be easy.[55] With care to avoid oversimplification, we nevertheless posit that the above dimensions comprise a useful "shorthand" for researchers and universities to consider when working towards the SDGs, whether conceiving a research proposal, working in partnership with others, advocating for system-wide changes to grant funding criteria, building capabilities, or instituting changes to their organisational structures and cultures.

Conclusions

Universities have unique characteristics that place the sector in a prime position to facilitate long-term, sustained change in line with the SDGs. To reach their full potential in fostering change through research, a priority for universities is addressing the integration agenda at the core of the SDGs. Universities will themselves need to transform to overcome the limitations of deeply siloed disciplinary domains, and embrace newer modalities of academic research that prioritise partnering across disciplines, beyond academia and in ways that reformulate role definitions separating expert researchers, participant-subjects and knowledge user-beneficiaries. There is also

---

[54] David Griggs, et. al. 'An integrated framework for sustainable development goals', *Ecology and Society* 19(4): 2014.
[55] Sandra Wooltorton et. al., 'Sustainability and action research in universities: Towards knowledge for organisational transformation', *International Journal of Sustainability in Higher Education*, 16(2015): 424-439.

a growing urgency for researchers and research units to expand their communication, engagement and advocacy functions, although this challenges traditional conceptions of the role of academia and the nature of independent research.

Each university has different strengths, and will have a unique pathway and approach to orienting their research activities towards achieving the SDGs. Supporting the development, growth and long-term existence of sustainable development research institutes is a universally applicable model. For these institutes to provide support and engage across faculty-based research, and for faculty-based researchers themselves to expand their influence, fundamental changes are also needed to the incentive structures facing all researchers. It might seem that conventional structures around research funding and academic recognition and progression seem to be entrenched in a state which is unfavourable to collaborative, transdisciplinary research. However, discrete but influential changes to such incentives can help encourage and reward research that focuses on the connectivity between systems, integrates knowledge across disciplines, addresses the messy complexity of sustainability challenges, and pursues the social justice and social equity objectives at core of the SDGs.

Bibliography

Australian Council for International Development, 'Principles and Guidelines for ethical research and evaluation in development.' Canberra: ACFID, 2017. Accessed 9 August, 2017. https://acfid.asn.au/sites/site.acfid/files/resource_document/ACFID_RDI%20Principles%20and%20Guidelines%20for%20ethical%20research12-07-2017.pdf

Australian Research Council, 'Engagement and impact assessment consultation paper'. Accessed August 8, 2017. http://www.arc.gov.au/engagement-and-impact-assessment

Australian Research Council, 'The Australian and New Zealand Standard Research Classification (ANZSRC).' Accessed 9 August, 2017. http://www.arc.gov.au/rfcd-seo-and-anzsic-codes

Bammer, Gabriele, 'Tools for transdisciplinary research' in *Transdisciplinary Research and Practice for Sustainability Outcomes,* Dena Fam, et. al., eds., (Oxon: Routledge, 2017), 39-55.

Baker-Shelley, Alex, Annemarie van Zeijl-Rozema, Pim Martens, 'A conceptual synthesis of organisational transformation: How to diagnose, and navigate, pathways for sustainability at universities?', *Journal of Cleaner Production*, 145 (2017): 262-276.

Carrard, Naomi, Joanne Crawford, Gabrielle Halcrow, Claire Rowland and Juliet Willetts. 'A framework for exploring gender equality outcomes from WASH programmes ', *Waterlines: international journal of water, sanitation and waste*, (32:2013): 315-333.

Castree, Noel, William M Adams; John Barry, Daniel Brockington, Bram Büscher, 'Changing the intellectual climate', *Nature Climate Change*; 4(2014): 763-768.

Chong, Joanne, Keren Winterford and Aleta Lederwash, 'Community Engagement on Water Futures: Using Creative Processes, Appreciative Inquiry and Art to bring Communities' Views to Life', *OzWater2017*, Conference of the Australian Water Association, 16-18 May 2017, Sydney.

Chong, Joanne, Pia Treichel and Anna Gero, 'Evaluating Climate Change Adaptation in Practice: A Child-Centred, Community-Based Project in the Philippines', in *Evaluating Climate Change Action for Sustainable Development*, edited by Juha I. Uitto, Jyotsna Puri, Rob D. van den Berg, 289-304. Springer Open, 2017.

Chong, Joanne and Stuart White, 'Urban—Major Reforms in Urban Water Policy and Management in Major Australian Cities' in Barry Hart and Jane Doolan, eds., *Decision Making in Water Resources Policy and Management*, Elsevier, 2017.

Demarco, Emily, 'Trump's proposed 2018 budget takes an ax to science research funding', *Science News*, May 26, 2017. https://www.sciencenews.org/blog/science-public/trump-proposed-budget-science-research-funding

Fam, Dena, 'Facilitating communities of practice as social learning systems: a case study of trialling sustainable sanitation at the University of Technology Sydney (UTS)', *Knowledge Management Research and Practice*, Springer Open, 1-9, 2017.

Fam, Dena, Tanzi Smith and Dana Cordell, 'Being a transdisciplinary researcher: skills and dispositions fostering competence in transdisciplinary research and practice' in *Transdisciplinary Research and Practice for Sustainability Outcomes,* edited by Dena Fam, Jane Palmer, Chris Riedy and Cynthia Mitchell, 77-93. Oxon: Routledge, 2017.

Fam, Dena, and Zoe Sofoulis, 'Trouble at the disciplinary divide: a knowledge ecologies analysis of a co-design project with native Alaskan communities, in *Transdisciplinary Research and Practice for Sustainability Outcomes,* edited by Dena Fam, Jane Palmer, Chris Riedy and Cynthia Mitchell, 236-253. Oxon: Routledge, 2017.

Filho, Walter Leal, 'Sustainable Development Research at Universities in the United Kingdom: Moving Forward', in *Sustainable Development Research at Universities in the United Kingdom: Approaches, Methods and Projects*, edited by Walter Leal Filho, 373-379. Springer International Publishing, 2017.

Grant, Melita, Chelsea Huggett, Juliet Willetts and Jane Wilbur, 'Gender Equality and Goal 6: The Critical Connection', Australian Water Partnership, 2017.

Griggs, David, Mark Stafford Smith, Johan Rockström, Marcus C. Öhman, Owen Gaffney, Gisbert Glaser, Norichika Kanie, Ian Noble, Will Steffen and Priya Shyamsundar. 'An integrated framework for sustainable development goals', *Ecology and Society* 19(4): 2014.

Gaziulusoy, Idil, 'Identifying and addressing challenges faced by transdisciplinary research teams in climate change research', *Journal of Cleaner Production*, 123(2016): 55-64.

Hannam, Peter, 'Climate science to be gutted as CSIRO', *The Sydney Morning Herald*, February 4, 2016, http://www.smh.com.au/environment/climate-change/climate-will-be-all-gone-as-csiro-swings-jobs-axe-scientists-say-20160203-gml7jy.html

Hoffman, Andrew and Jessica Axson, 'Examining Interdisciplinary Sustainability Institutes at Major Research Universities: Innovations in Cross- Campus and Cross-Disciplinary Models' *Working Paper No. 1366*, Ann Arbor, MI: University of Michigan, 2017.

ISF-UTS, 'SDGs: Mapping our research.' Accessed August 7, 2017. http://www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/our-research/sdgs-mapping-our

Ison, Ray, 'Transdisciplinarity as transformation: a cybersystemic thinking in practice perspective', *Transdisciplinary Research and Practice for Sustainability Outcomes,* edited by Dena Fam, Jane Palmer, Chris Riedy and Cynthia Mitchell, 55- 75. Oxon: Routledge, 2017.

Jantsch, Erich. 'Towards interdisciplinarity and transdisciplinarity in education and innovation' in *Interdisciplinarity: problems of teaching and research in universities,* edited by Apostel L Berger G. Briggs A. and Michaud G., 97-121. Paris: OECD, 1972.

Janstch, Erich, 'Inter- and transdisciplinary university: A systems approach to education and innovation', *Higher Education*, 1(February 1972): 7–37.

Kagan, Carolyn Rebecca Lawthom, Ornette Clennon, Jenny Fisher, John Diamond and Katy Goldstraw. 'Sustainable Communities: University-Community Partnership Research on Social Dimensions of Sustainable Development', in *Sustainable Development Research at Universities in the United Kingdom: Approaches, Methods and Projects*, edited by Walter Leal Filho, 245-262. Springer International Publishing, 2017.

Kass, Gary, Ben Shaw and Fred Steward, 'The UK Sustainable Development Research Network— Bridging the Sustainability Science/Policy Divide', in *Sustainable Development Research at Universities in the United Kingdom: Approaches, Methods and Projects*, edited by Walter Leal Filho, 279-294. Springer International Publishing, 2017.

Kestin, Tahl, Marjan van den Belt, Leanne Denby, Katie Ross, John Thwaites and Martine Hawkes, 'Getting started with the SDGs in universities: A guide for universities, higher education institutions, and the academic sector', Melbourne: Sustainable Development Solutions Network (SDSN) – Australia/Pacific in collaboration with the Australasian Campuses Towards Sustainability (ACTS) and the global SDSN Secretariat, 2017, *forthcoming.*

Knott, Matthew, 'Bjorn Lomborg research centre dropped by Turnbull government: Simon Birmingham', *The Sydney Morning Herald*, October 21, 2015. http://www.smh.com.au/federal-politics/political-news/bjorn-lomborg-climate-centre-dropped-by-turnbull-government-simon-birmingham-20151021-gkek0s.html

Lawrence, Roderick J., 'Beyond Disciplinary Confinement to Imaginative Transdisciplinarity', in *Human Experience in the Natural and Built Environment: Implications for Research, Policy and Practice*, IAPS 22 Conference, Abstracts of Presentations. IAPS, 2012.

Leahy, Caitlin, Keren Winterford, Nghiem Phuong Tuyen, Lee Leong and Juliet Willetts, 'Research collaboration for impact evaluation: Case of a gender and wash study in central Vietnam', *Development Bulletin*, 79(2017) (forthcoming).

Leal Filho, Walter ed., *Sustainable Development Research at Universities in the United Kingdom: Approaches, Methods and Projects,* Springer International Publishing, 2017.
Turney, Chris "CSIRO cuts: as redundancies are announced, the real cost is revealed", *The Conversation*, May 26, 2016, https://theconversation.com/csiro-cuts-as-redundancies-are-announced-the-real-cost-is-revealed-59895

Loorbach, Derk, Niki Frantzeskaki and Flor Avelino, 'Sustainability Transitions Research: Transforming Science and Practice for Societal Change', *Annual Review of Environment and Resources*, 42(2017):4.1-4.28

Mataix, Carlos, Sara Romero, Javier Mazorra, Jaime Moreno, Xosé Ramil, Leda Stott, Javier Carrasco, Julio Lumbreras and Inmacula Borrela, Abstract 'Working for Sustainability Transformation in an Academic Environment: The Case of itdUPM', in *Sustainable Development Research at Universities in the United Kingdom: Approaches, Methods and Projects,* edited by Walter Leal Filho, 391-408. Springer International Publishing, 2017.

Milman, Oliver, 'Climate scientists face harassment, threats and fears of 'McCarthyist attacks'', *The Guardian*, 23 February 2017. https://www.theguardian.com/environment/2017/feb/22/climate-change-science-attacks-threats-trump

Mitchell, Cynthia, Dena Fam and Kumudini C. Abeysuriya, 'Transitioning to sustainable sanitation: a transdisciplinary pilot project of urine diversion'. Sydney, ISF-UTS, 2013.

Mitchell, Cynthia, Dana Cordell and Dena Fam, 'Beginning at the end: the outcome spaces framework to guide purposive transdisciplinary research' , in *Transdisciplinary Research and Practice for Sustainability Outcomes,* edited by Dena Fam, Jane Palmer, Chris Riedy and Cynthia Mitchell, 25-39. Oxon: Routledge, 2017.

Nelson, Michael and John Vucetich, 'On Advocacy by Environmental Scientists: What, Whether, Why, and How' *Conservation Biology*, 23, 5(2009): 1090–1101.

Patton, Michael Quinn, *Developmental Evaluation: Applying Complexity Concepts to Enhance Innovation and Use*. New York: The Guildford Press, 2011.

Perez, Pascal and David Batten Eds., *Complex Science for a Complex World Exploring Human Ecosystems with Agents*, Australian National University E Press, Canberra, Australia, 2003.

Popa, Florin, Mathieu Guillermin, Tom Dedeurwaerdere, 'A pragmatist approach to transdisciplinarity in sustainability research: From complex systems theory to reflexive science', *Futures*, 65(2015): 45-56.

Riedy Chris, Alison Atherton and Jenni Downes, 'Market Transformation for Energy Efficiency: Stage 2 Report.' Sydney: ISF-UTS, 2016.

Robinson, John, 'Being undisciplined: Transgressions and intersections in academia and beyond.' *Futures*, 40 (2008): 70-86.

Rutovitz, Jay, Ed Langham, Sven Teske, Alison Atherton and Lawrence McIntosh, 'Virtual trials of Local Network Charges and Local Electricity Trading: Summary Report.' Sydney:ISF-UTS, 2016.

Schmalzbauer, Bettina and German Committee Future Earth Secretariat, 'The Contribution of Science in Implementing the Sustainable Development Goals', Stuttgart: German Committee Future Earth, 2016.

SDSN Australia/Pacific and ACTS, *Mapping University contributions to the SDGs,* Webinar, 1 May 2017. Accessed 9 August, 2017. https://youtu.be/PbET71egLzw.

UC Davis, 'UC Davis West Village; About West Village', accessed August 3, 2017. http://westvillage.ucdavis.edu

United Nations, 'Information for integrated Decision-Making & Participation', *Sustainable Development Knowledge Platform*, accessed August 3, 2017. https://sustainabledevelopment.un.org/topics/information-integrated-decision-making-and-participation

Voytenko, Yuliya, Kes McCormick, James Evans, Gabriele Schliwa, 'Urban living labs for sustainability and low carbon cities in Europe: towards a research agenda', *Journal of Cleaner Production*, 123(2016): 45-54.

White, Stuart, Anastasia O'Rourke, and Emma Aisbett, 'Extending the Responsibility: Packaging and the Beverage Industry', paper presented at the 11th International Conference of Greening of Industry Network San Francisco, October 12-15, 2003.

Willetts, Juliet and Cynthia Mitchell, 'Assessing transdisciplinary doctoral research: quality criteria and implications for the examination process' in *Transdisciplinary Research and Practice for Sustainability Outcomes,* edited by Dena Fam, Jane Palmer, Chris Riedy and Cynthia Mitchell, 122-137. Oxon: Routledge, 2017.

Willetts, Juliet, Naomi Carrard, Joanne Crawford, Claire Rowland and Gabrielle Halcrow, 'Working from strengths to assess changes in gender equality, *Development in Practice*, 23(2013): 991–1006.

Winterford, Keren, Anna Gero, Caitlin Leahy and Janina Murta, 'Beyond partnerships as a process - Designing research partnerships for impact and change', material presented at the 'Beyond partnerships as a process - Designing research partnerships for impact and change' workshop, Research for Development Impact Conference, Sydney, June 13, 2017.

Wooltorton, Sandra, Anne Wilkinson, Pierre Horwitz, Sue Bahn, Janice Redmond and Julian Dooley, 'Sustainability and action research in universities: Towards knowledge for organisational transformation', *International Journal of Sustainability in Higher Education*, 16(2015): 424-439.

World Wide Views, 'Worldwide Views on Climate and Energy, June 6 2015' accessed August 3, 2017. http://climateandenergy.wwviews.org/national-and-regional-partners/

Worthington, Richard, Mikko Rask and Lammi Minna eds., *Citizen Participation in Global Environmental Governance*, Earthscan, London, 2012.