Title	Sustainable knowledge transformation in and through higher education: a case for transdisciplinary leadership
Author(s)	Khoo, Su-Ming
Publication Date	2017-03-01
Publication Information	Khoo, Su-Ming. (2017). Sustainable knowledge transformation in and through higher education: A case for transdisciplinary leadership. International Journal of Development Education and Global Learning, 8(3), 5-24. doi: 10.18546/IJDEGL.8.3.02
Publisher	UCL IOE Press
Link to publisher's version	https://doi.org/10.18546/IJDEGL.8.3.02
Item record	http://hdl.handle.net/10379/6754
DOI	http://dx.doi.org/10.18546/IJDEGL.8.3.02

International Journal of Development Education and Global Learning 8:3, 5-24 [ISSN: 1756-525X]

Sustainable Knowledge Transformation in and through Higher Education: a case for transdisciplinary leadership

Su-Ming Khoo
National University of Ireland, Galway
suming.khoo@nuigalway.ie

Abstract

This article explores inter and transdisciplinarity, given the need for more complex, relevant and transformative knowledge to shift society toward more sustainable futures. It connects practical questions about economic, societal and ecological limits to questions about the limitations of academic knowledge. Transdisciplinarity involves co-constructing socially relevant, transformative knowledge with actors outside academia. In practice, transdisciplinary work requires clarity about intentions, inclusive and well- facilitated collaborative processes accommodating dissenting and transgressive perspectives. Higher education has begun to experiment with inter and transdisciplinarity via sustainability focused projects. However, it insufficiently addresses broader demands for transformation and cannot achieve this without integral leadership.

1. Introduction

This article explores current arguments about inter and transdisciplinarity. There is an urgent need for more complex, relevant and transformative knowledge to shift global society in the direction of more economically, socially and ecologically just and sustainable futures. This is envisaged by the seventeen UN Sustainable Development Goals (SDGs) for 2016-2030. The discussion begins with the challenge to academic knowledge, which has been traditionally organized according to discipline-based subjects. Disciplines have formed the basis of scientific autonomy and trustworthy expertise, but their status is challenged by critiques of relevance, adequacy and legitimacy. It has been suggested that higher education has contributed too little, even negligibly to the essential goals of transforming the world, failing to lead a transition toward a secure, sustainable future (Shiel & Jones, 2016). Other critics have suggested that producing disciplinary knowledge for its own sake is an unsustainable practice, questioning autonomous academic expertise as justifiable on its own terms (Frodeman, 2014).

The article introduces inter and transdisciplinarity by outlining three basic approaches: systemic, dissenting and pragmatic. Holistic scientific 'systems' approaches are appealingly coherent (Jantsch, 1972; Alvargonzalez, 2011), but they are theoretically abstract and can be challenged by dissenting (Parker and Samantrai, 2010) approaches that challenge the 'scientific' consensus and make concrete demands for social justice. Neither approach is sufficient to move forward as sustainability problems that need to be addressed are complex and 'wicked' (Rittel & Webber, 1973; Conklin, 2006). Pragmatic transdisciplinarity takes a more open approach, focusing on bringing together different types of academic and non-

academic actors to collaboratively discuss, learn about and solve complex practical problems. This approach offers significant potential for transformative change toward sustainability. Sustainability encompasses the global development, environmental and social justice struggles that comprise key areas for interdisciplinary research, education and action for transformation. These issues offer potentially complementary, but also possibly competing grounds for higher education to engage transdisciplinarity. The issues can be brought together via interdisciplinary topics for research, learning and public consultation, for example climate change, migration, food systems, health systems, or gender equality. Such topics open up opportunities to re-integrate and re-orient higher education's research, teaching and engagement activities toward sustainability goals. However, the complexity and 'wickedness' of each of these topics means that struggles over what constitutes legitimate knowledge are unavoidable, hence this article argues for the practical conduct of transdisciplinarity as inclusive, critically reflexive learning practice. The engagement of a more diverse and inclusive set of actors, perspectives and values is key to the development of transformative leadership in, and through, higher education. Transdisciplinary work envisages a complementarity between the processes of external engagement for collective problem solving and internally oriented reflection and learning. It is arguably particularly necessary for public higher education institutions to focus on re-integrating and transforming systems for collective and public good. Public good perspectives are needed to complement and counterbalance the more politically popular focus on developing private individuals' (or corporate entities') identities, values and capabilities (Walker & Boni, 2013). Higher education should play a key role in defining the public good and fostering collective capabilities because universities are highly trusted organisations (Mighall, 2008) and societies expect higher education to cultivate the 'best' features of society and serve as beacons of enlightened, progressive thought. Higher education is expected to take 'a longer view of decisions and actions and to put larger interests above our own' (Berkeley Haas, 2015). Social responsibility is embedded in most university missions and it has become commonplace for institutions to report on their fulfilment of social responsibility goals (Dagilienė & Mykolaitienė, 2015).

Higher education leadership finds itself having to connect fundamental ethical, political and cultural questions about societal transformation with pragmatic concerns about its own changing shape and purpose. Long-established traditions of academic autonomy are being radically challenged. These challenges to higher education are, in turn, located within a larger global context of crises, high tides of policy reform and diverse contexts of rapid and disruptive change. Thus, the broad issues which are the subject of this article - leadership and transformation of society and the role of higher education, sustainable development and social justice - are irretrievably enmeshed in myriad economic, political and social pressures, new technologies and renewed economic, social and political demands. While there is some consensus around the need for transformation, there is much less consensus around what transformed higher education should look like. Meanwhile, the broader vision of what societal transformation should look like is deeply contested. The main activities of higher education – research and curriculum, have become contested and contesting spaces and terrains (Prinsloo, 2016).

The 'trans' in transdisciplinarity refers to 'what is between, across, and beyond disciplines', transcending dichotomous, either/or positions (McGregor, 2015). Transdisciplinarity attempts to take knowledge to a new plane of integration and action, through the involvement of societal actors beyond the academy in co-constructing knowledge, to serve socially relevant and transformative purposes (Max-Neef, 2005). While traditional forms of scientific and

academic thought privilege predictability, linearity, dualism, reductionism, exclusive logic and control, transdisciplinarity is predicated on complexity, emergence and inclusive logic. Inclusive logic accepts in principle that problems are 'messy' and there may be many 'realities', however differing logics are assumed to complete each other, not act as rival logics cancelling each other out (McGregor, 2015). What remains hard to see, or is missing in this complexity is the fundamental transformative motivation, or the 'why' at the centre of the 'how' and the 'what' of transformation. Critical voices have found higher education leadership to be inhibited in its propensity and capacity to engage systematically in global challenges. Instead, it remains overly focused on short term, organizational goals (Shiel and Jones, 2016:17), hence the 'why' question is perhaps the critical element for transformative and integral leadership (Sinek, 2011), but these questions are more likely to come from outside academia, rather than from within.

2. Limits to disciplinary knowledge: the search for integration and transcendence

Inter and transdisciplinarity have emerged out of challenges to the disciplinary status quo in research and education. The word 'discipline' can be traced to the Latin root word *discere*, to learn, linking the concept to *discipulus*, followership and *disciplinis*, knowledge that is taught and learned in a specific way, with connotations of authority and possibly punitive control (Oxford University Press, 2016.). Disciplines are constituted as knowledge that is gathered together and nominally unified by *audiences* (Turner, 2000; Frodeman, 2014). 'Disciplines' are always problematic because every act of demarcation immediately creates problems of inclusion and exclusion at its boundaries (Liesenfeld, 1993). 'Inter', meaning 'among, together, mutually or reciprocally', is different from 'multi', which simply means 'many' (Alvargonzalez, 2011:388). Multi or pluridisciplinarity refers to uncoordinated cooperation between disciplines. Interdisciplinarity on the other hand, involves coordination and cooperation between disciplines. This points to a higher-level determining principle, which might be values based (eg justice; equality); normatively based (eg planning for healthier cities) or pragmatically based (eg carrying out a programme to reduce waste) (Max-Neef, 2005). Transdisciplinarity (Alvarenga, et al., 2005) tries to connect specialists and generalists from different areas. It may reflect universalizing ambitions to scientifically integrate knowledge or praxis-oriented justifications to humanize science. Transdisciplinarity is processual and dialogic in orientation, taking complexity, different levels of reality and the logic of the 'included middle' as axiomatic principles (Max-Neef, 2005). Transdisciplinarity characteristically focuses on 'wicked problems' which require creative solutions, stakeholder involvement, and the practice of engaged and socially responsible science (Bernstein, 2015). A 'wicked problem' is a problem that is hard to solve definitively because there are competing ideas about it, leading to different and competing solutions. 'Wickedness' describes a combination of incommensurability and intractability, which heightens as complexity increases (Conklin, 2006; Rittel & Webber, 1973). An exemplary 'wicked problem' addressed by inter and transdisciplinary approaches to sustainability is food security (Foran, et al., 2014). A given food system has multiple, potentially competing and complementary points for intervening. Food security is a contested, evolving, multi-dimensional construct, which concerns dimensions such as availability, physical access, economic affordability, modes of consumption and utilization, agroecosystemic sustainability and resilience. There are divergent theoretical framings on what constitutes a food system, underscoring a wide range of interests and actors (Foran et al, 2014).

Frodeman (2014: 19) argues that disciplinary autonomous 'science' is unsustainable because it is focused on internal academic disciplines, and governed by academic peer review, not 'people and social roles'. The proliferation of alternative information sources in today's

information society means that people have less need for 'experts' and can rely on their own definitions and opinions. However, there is little room in this critique for academic-society collaboration or to recognise conflicts between different knowledge needs. This critique of disciplines fails to consider how to deal with potential conflicts between governmental, institutional and individual demands for learning, development and transformation. Conflict and contention seem inescapable, given an actually-existing situation of a radically interconnected and commodified, but extremely unequal world where manifest injustice (Sen, 2009) and unsustainability (Barry, 2012) already exist and loud demands for justice and resources cannot be ignored.

Transdisciplinary programmes call for academics to stop speaking only amongst themselves and their own academic 'tribe' and territory, and to reach beyond the academy to engage with external audiences (Davis et al, 2014). This article concurs that inter and transdisciplinarity are necessary and laudable for sustainability and the larger public good, but it disagrees with the claim that it is 'unsustainable' to produce 'too much knowledge' for its own sake. Knowledge is not inherently scarce as it increases in both quality and quantity as it is used and cannot be 'used up'. The public good function of science requires fundamental disciplinary knowledge to be maintained in order to serve the longer-term public good (Khoo, 2016), for example providing scientific consensus on what drugs are safe and effective, or what limits should be set on carbon emissions to mitigate climate change.

Many of key works on interdisciplinarity approach it in an applied and practical, 'how to' manner (Klein & Newell, 1996; Newell, 2007; Schauppenlehner-Kloyber & Penker, 2015). Newell, for example, sets out a stepwise procedure for defining a problem, determining relevant disciplines, commanding and gathering disciplinary knowledge, identifying conflicts, creating common ground, identifying disciplinary linkages, constructing, modelling and testing more comprehensive understanding (Newell, 2007). This procedure for 'doing' inter-disciplinarity challenges the academic status quo and points to the necessity of knowledge co-production, bringing in other actors such as civil society organizations and business interest groups.

Interdisciplinarity implies a degree of synthesis or harmonization across disciplines, with the intention to move in more coordinated, coherent and holistic directions (Choi & Pak, 2006). The prefix 'trans' implies a 'going beyond' type of integration that involves transcendence or transformation (Alvargonzalez, 2011). Choi and Pak's discussion of transdisciplinarity suggests that natural, social and health sciences can be integrated within a humanities context that basically connects the 'what' questions, and the 'how' strategies' with the bigger 'why' questions. Interdisciplinarity in the sciences sometimes results from the 'how' driving the 'what' - new functional technologies push scientific practice outside what the discipline is used to (Choi & Pak, 2006). This pragmatic, materialist view of interdisciplinarity challenges abstract, formal boundaries simply by requiring 'operational material continuity' and the recognition of common principles. Examples given for 'common principles' are mechanics or thermodynamics (Alvargonzalez, 2011: 394), but ethical and ecological principles such social justice, human rights or environmental limits could offer workable bases for more inclusive conceptions of interdisciplinarity. Transdisciplinarity demands a certain degree of deconstruction, and acceptance of different levels of reality, paradoxes and conflicts. Ethical and ecological reasoning are useful in generating dialogue and agreement within contested spaces. Ethics enables the enunciation of different arguments and logics while ecology highlights interdependencies, conditions of possibility and limitations.

Transdisciplinarity is associated with 'mode 2' applied or problem solving knowledge and 'post-normal science' (Nowotny & Gibbons, 2001), while 'mode 1' or 'pure' science serves longer-term general public interest, but traps it within rigid disciplinary boxes. 'Post-normal science' accepts that uncertainties and ethical complexities have to be managed and a multiplicity of perspectives and commitments need to be brought into dialogue. A problematic tendency that needs to be avoided is the urge to reduce dialogue down to a single, one dimensional standard value, price or '*numeraire*' (Funtowicz & Ravetz, 1994). A single 'truth' is probably unachievable, nor even desirable, given the uncertain nature of knowledge. Post-normal science reflects both the uncertainties of natural systems and the diversity of relevant human values, meaning that a singular, unified, scientific 'solution' may be an illusory goal (Alvargonzalez, 2011).

Interdisciplinarity is a methodological and practical response to the challenges and limitations of disciplinary knowledge. Interdisciplinary programmes such as environmental studies, human rights, women's studies and critical race studies arose out of movements for intellectual and social change. Social struggles motivated work across disciplinary boundaries, to collect together, reintegrate and reconstruct knowledge, in new ways and with new participants. Many interdisciplinary efforts have historical roots in broader-based political and social movements that challenge authority and authoritative knowledge as oppressive, even 'epistemicidal'. Radical critiques of academic knowledge warn against the oppressive effects of ignoring non-academic forms of knowledge: 'to turn us into ignorants, so that we can be treated as ignorants in conscience' (Santos, 2014: 12). Critical race, indigenous, feminist and decolonial traditions of interdisciplinarity demand justice (Parker & Samantrai, 2010) and recognition for non-authoritative persons, ways of being and knowledges, such as ethnic and racial minorities, indigenous peoples and feminist care concerns. Inter and transdisciplinary enquiry is therefore intrinsically challenging in order to be potentially transformative. It is inescapably enmeshed with specific demands for justice and wider questions of what constitutes legitimate knowledge with attendant dilemmas of ethics, responsibility and questions of who speaks for whom and raises questions about silences and absences in what is considered legitimate knowledge (Santos, 2014).

Debates about knowledge and 'social responsibility' are shadowed by deep philosophical and methodological questions concerning the possibility of purely 'objective', detached knowledge. Further ethical concerns and questions surround how researchers treat the individuals, populations and subjects under investigation and how they are involved in the 'results' of research – whether they are treated as 'data' or as participants. The 'post-normal science' paradigm allows researchers to own up to their own subjectivity, while more carefully considering the ethics of research, especially where there are significant power and privilege differentials between the investigator and the subject of research. Such epistemological and ethical considerations bring standard 'scientific' knowledge into question and put research participants on a more equal footing with scientific investigators (Bernstein, 2015), as co-participants in knowledge. Transdisciplinary principles of the 'included middle' and different levels of reality allow research processes to accommodate dialogue between minority and majority cultures and include participants from outside the academic community, while striving to transcend the traditional dichotomy between objective and subjective viewpoints.

At the centre of the debates on inter and transdisciplinarity sits a contention about the status and autonomy of science – whether science does, or should, exist as an autonomous and self-organising good. Is scientific autonomy an unaffordable and unjustifiable indulgence?

Government investment in research leads to a *quid pro quo* mentality – demanding that science serve the administration's social and political goals (Khoo, 2016). Michael Polanyi observed that the 'republic of science' operates analogously, but not identically to the capitalist market - the two should not be confused. Science is analogous to the market in the sense that it is made up of freely cooperating independent agents, exchanging information. However, scientists '[respond] directly to the intellectual situation created by the published results of other scientists … motivated by current professional standards' (Polanyi, 1962: 55). Fundamental scientific knowledge and 'professional standards' are essentially disciplinary and only serve the common or public good indirectly, and in the longer term, by seeking and advancing knowledge on its own terms.

The Polanyian argument for scientific autonomy argues that public should support autonomous science, yet desist from demanding that it serve only immediate, state-designated public purposes. Subordinating all science to immediate logics of politics, market and profit could potentially weaken and block fundamental scientific advancement and capacity in the longer run. Consciously or unconsciously, Jantsch (1972) reflected on scientific autonomy when proposing that societies should look first to transdisciplinary science to determine what social goals should be, given the difficulty and uncertainty that industrialized societies faced in the transition to a post-industrial era. The view that has prevailed since the 1990s is markedly different. Public support for mode 1 science has declined, while demands for direct applicability, 'relevance' and 'impact' have grown. Science and education have been comprehensively re-oriented towards immediate economic, social and political demands, while public resourcing for science has declined and the resource gap has been partly filled by private, for-profit or philanthropic investments.

A weakness of the techno-scientific view of transdisciplinary, Mode 2 knowledge lies in the assumption that systemic convergence and integration will take place unproblematically, once a problem orientation is agreed, for example global warming, gender discrimination, or conflict (Alvargonzalez, 2011). Moran argues that interdisciplinary studies in the humanities tend to challenge the pre-eminence of science itself, pointing to the complicity of scientific advancement with colonial and modern forms of exploitation and injustice (Moran, 2002). The literature on scientific transdisciplinarity tends to overlook considerations of politics and social justice which have been central to challenging the traditional disciplines and conditions of knowledge production since the 1960s. These struggles extended beyond academic disputes to involve social movements for justice, led by disenfranchised groups who were struggling to gain symbolic recognition and access to knowledge production. Interdisciplinary debates are historically intertwined with efforts to critically question different, intersecting forms of privilege and oppression and to challenge taken-for-granted assumptions about race, class, gender, colonization and sexuality (Parker and Samantrai, 2010). Indeed, contestation has been notably increasing on higher education campuses around the world on issues of coloniality, oppression and injustice. Friedman, writes (in conversation with Seidman) about increased moral arousal in an 'Age of Protest', as social media has led to reduced moral distancing and heightened empathy. Problems of discrimination and institutional racism are being continuously contested, which may be a sign of healthy and timely re-engagement. However, moral arousal also frequently manifests as forms of outrage which repress rather than engender serious conversation and truth (Friedman, 2016), possibly reinforcing a 'culture of victimhood' (Knight, 2016). This context calls for empathetic and courageous leaders with the capacities to channel moral outrage into ethical, serious and truthful conversations and toward transformative futures.

Interdisciplinarity can be understood as working on two planes in higher education: horizontally in terms of academic subjects or disciplines where research and education are conducted, and vertically in terms of different domains of higher education activity, such as policymaking, administration, curriculum, pedagogy, civic engagement, support and care. In addition to disciplinary differences marking academic tribes and territories (Trowler, 2012; Becher & Trowler, 2001), academic policies and practices also span formal to non-formal and collective-individual dimensions. Inter-disciplinarity must address a range of academic practices, actors and 'economies', with different, often contradictory, expressions and interplays of dominating, subordinated and resistant identities. For example, academic activities may be discipline-defined or practice-defined. Research and teaching are not the only knowledge activities that academics are engaged in. Academics also have leadership, management, administrative, and public intellectual roles which they carry out within their specific academic or professional disciplines, and within their academic institutions. These different roles may lead to ambivalent or conflicting positionings, as rationales for research, teaching, topic-based activism, and for institutional or disciplinary leadership may conflict with each other.

3. Sustainability as the ground for inter/transdisciplinary practice

Higher education has mainly focused on questions surrounding sustaining its own survival and legitimacy via measures to enhance economic growth and employability. However, these priorities are insufficiently integrated with the development of broad 'sustainability literacy' (Filho, et al., 2016) to drive societal transformation away from unsustainable development and toward more socially and environmentally sustainable pathways. Filho and others suggest that project-oriented or 'project-based learning' can support integrative approaches to sustainability in a higher education context. They argue that such approaches should become routine in higher education. However higher education's efforts should not only be confined to traditionally defined students, it needs to include a wider ambit of relevant stakeholders from wider society (Sterling, 2004) through practices of engaged (Boyer, 1996) and 'public' (Burawoy, 2005) scholarship. The transformative vision cannot be achieved only through individual small scale teaching and learning projects, as it requires the possibility for scholars and practitioners from many different disciplines to engage in a long-term common learning process, becoming a' 'thought collective' capable of initiating paradigm transformation (Klay, et al., 2014, p. 72).

Frodeman (2014: 60) expansively claims that 'sustainability should become the master trope of interdisciplinarity'. His assertion rests on a formalistic analogy - that academic disciplines and the environment share a concern with limits. The academic disciplines are unsustainable in their unlimited quest for expertise, while environmentalism poses a challenge to the quest for capitalist development that ultimately rests on limitless growth. The principle of environmental limits is essential in sustainability, but ecocentric views may be challenged by competing social and economic demands. Scientifically objectivist (Alvargonzalez, 2011) and socially dissenting (Parker & Samantrai, 2010) perspectives on trandisciplinarity and sustainability may become locked in tension. Solidaristic and redistributive approaches are needed to attain social justice within environmental limits, however generous and hospitable initial conditions are needed to foster openness and trust as preconditions for dialogue, since it will be not be easy to arrive at shared transformative understandings and purposes under limit conditions.

Klein (2010) argues that integration, transgressiveness, holism and problem-solving characterize trandisciplinarity. Transdisciplinarity tackles problems on their own practical

level, but also raises meta-questions about problem choice and definition (Klein, 2004) . Bernstein (2015) suggests that transdisciplinarity is historically rooted in the intellectual, ecological and counter-cultural revolutions that took place from the mid-1960s to the early 1970s. The first writings on transdisciplinarity reflected a particular moment when ecological thinking intersected with challenges to established views of knowledge and education. Higher education served as a key space for countercultural contestation and social experimentation. The initial flush of inter and transdisciplinary thinking took place following several decades of concerted government investment in education and science. This led to a sense of techno-optimism, albeit overshadowed by militarism and the Cold War. Systems thinking and interconnectedness began to feature in countercultural and innovative theory and public intellectual positions, for example Kenneth Boulding's (1966) popular concept of 'Spaceship Earth' and Marshall McLuhan's (1964) 'Global Village'.

This countercultural moment was eclipsed only a few years later by the 1974 OPEC oil crisis, which set in motion a rollback from public investments, including higher education and research in the advanced economies. This was followed by the decade of disinvestment and growing polarization throughout the 1980s, putting on hold the promise of a global transformation driven by science and education. Militarization, the intensification of the Cold War and its proxy wars and a generally scepticism about internationalism obstructed the vision for a peaceful, interdependent and more socially just world. Co-operation and collaboration within higher education continued in compartmentalized interdisciplinary spaces - women's and gender studies, environmental science, urban studies, and cognitive science (Klein, 1996), disability, peace and conflict studies (Parker & Samantrai, 2010). However, transdisciplinarity failed to gain wider currency as a concept, remaining on the margins of research and education until the early 1990s (Bernstein, 2015). The increasing understanding of scientific and social interdependence and systematicity was stymied by a combination of the ending of the 'golden age of the welfare state' (Marglin & Schor, 1990), and the intensification of the Cold War. North-to-South global redistribution and development cooperation declined in the 1980s, as financial flows reversed, deepening the polarization between the Northern and Southern blocs (Millet & Toussaint, 2004).

The opportunity for transdisciplinary thinking came around again with the end of the Cold War, and the UN Environmental Programme's Rio Earth Summit in 1992. At this point, highly complex, global concerns such as climate change pushed their way to the fore again, demanding the transcendence of disciplinary thinking. The interconnectedness of science, technology, social problems, policy, education, and the arts regained currency after a two decade-long hiatus. The timing of the first move toward transdisciplinarity in universities in 1970 (Jantsch, 1972) and later First World Congress on Transdisciplinarity, over two decades later, should not come as a surprise. Jantsch's early work on re-envisioning higher education curricula reflected a combination of systemic (Meadows, et al., 1972), counter-cultural (Roszak, 1969) and techno-speculative (McLuhan, 1967) intellectual alternatives, to present radically innovative and alternative proposals about knowledge and the future. Coming after the Apollo space landings, new images of the Earth from space crystallized a new social imaginary of planetary limits and systematicity. These constituted the original conditions for the emergence of inter and transdisciplinary sustainability discourses within a general understanding of globality and interdependence, signalled by the first UN Environmental Programme Conference in Stockholm in 1972. Frodeman contends that the essence of sustainability is the sense of limitation, and sustainability was arguably made imaginable by the visualization of Earth as a singular planet, in all its uniqueness and fragility.

Following the 1992 Rio Summit, the first World Congress on Transdisciplinarity was held and a Charter on Transdisciplinarity agreed upon (Klein, 2001; Bernstein, 2015). These gatherings particularly addressed the role of universities and suggested that the 'universities of tomorrow' would move towards a transdisciplinary evolutionary path (CIRET-UNESCO, 1997). However, these conversations reflected a highly abstract theoretical view, the 'Nicolescuian School' of transdisciplinarity which is described as boldly visionary, even 'oracular' or mystical (Bernstein, 2015:5). A more descriptive, pragmatic, problem-solving approach is identified with the 'Zurich school' of transdisciplinarity, associated with social and policy sciences, such as science and technology studies and education. (Klein, 2001; McGregor, 2015). The 'Zurich' school centres around the 'td-net' grouping of Swiss researchers working largely on environment and ecology issues. 'Zurich school' transdisciplinarians reflect the 'Mode 2' approach to socially relevant and responsible knowledge production (Gibbons, et al., 1994). A more diversified and open-ended concept of 'postnormal' science (Funtowicz & Ravetz, 1993), involves multidisciplinary teams of academics and various other social actors and stakeholders, brought together for more limited periods of time to work on specific, applied, 'real world' problems, such as urban design (Schauppenlehner-Kloyber & Penker, 2015) or food security (Foran, et al., 2014).
It is an unresolved question whether different knowledges or epistemes, multiple and heterogenous disciplines and beliefs can be unified, and if so, how. The leading transdisciplinarian, Morin names three fracture sites or 'emergence levels': the physical, the biological and the anthropo-sociological. Morin suggests that differences are resolved by first entrenching the social sciences in the life sciences, and then the life sciences into the natural sciences, using systems theory, cybernetics and information theory (Alvargonzalez, 2011, p. 397). Alternatively, a somewhat opposite process would integrate the natural, social and health sciences into a humanities context (Choi & Pak, 2006). Nicolescu actually did emphasise the necessity of overcoming ethnocentrism, using dialogue to give rise to a fusion of horizons, and warned against attempts to simply subsume one type of knowledge into another (Alvargonzalez, 2011). The desire for a single, unified and ordered world can drive research into an erroneous direction, since the different levels of reality are impossible to fully resolve (Alvargonzalez, 2011).

Pragmatic transdisciplinarians argue that the relevant sustainability challenges will be inescapably complex, have ambiguous problem definitions and unclear or conflicting and dynamically changing goals. If higher education is to contribute towards transdisciplinary research and learning, it must enable societies to deal with uncertainty and complexity by including non-traditional, non-academic actors into their research and education activities and seek to foster wider social learning. Some of the new transdisciplinarity literature argues for a focus on how to design and facilitate appropriate group processes for these new constituencies, and understand group dynamics, a knowledge and skill set that is already highly developed amongst global educators and the community development sphere. This focus on process identifies several priorities for higher education leaders to focus on: including fostering researchers' responsibility in processes of societal change, recognising the usefulness of external facilitators, allowing sufficient scope and time for group building, and acknowledging that there are different phases of group process and variable requirements for social learning (Schauppenlehner-Kloyber & Penker, 2015). Pragmatic transdisciplinarians point to a need to foster forms of reflexivity that are clearly capable of supporting the development of social learning and social experimentation processes as these are key to supporting sustainability transitions (Popa, et al., 2015). They argue that conceptions of reflexivity should avoid the tendency to unproblematically legitimize abstract and theoretical

presentations of 'complex systems science' while ingoring the roles of 'non-scientific expertise' and social innovators in the design of research and learning processes.

4. Conclusion: integral leadership for inter and transdisciplinarity shifts in higher education.

Higher education authorities are currently fully occupied with stressful internal processes of acceleration and existential crises of identity, economic viability, legitimacy and survival. These are insightfully discussed in the 'Accelerated Academy' blogs curated by Mark Carrigan at the London School of Economics (Carrigan, 2015). This leaves little focal space for broader, deeper and more integral learning and transformation to attain sustainability. Higher education leadership must manage a profound transformation toward new ways of collaborative transdisciplinary working, as it simultaneously struggles with the survival and futures of its own institutions and practices.

Disciplinary 'academic tribes and territories' are becoming less relevant as interdisciplinary demands are becoming more salient (Trowler, 2012). Research has moved away from discipline-defined academic freedom, ('donnish dominion' in Trowler's terms) to a model driven by the need to demonstrate 'impact' and 'useability', often according to non-discipline-specific and market-driven or market-mimicking criteria. Universities and research institutions are driven to corporatize their mission and activities, using commercial symbols and strategies. Managerialism, enterprise culture and fiscal crises have shifted the ground of academic values. The model of academic tenure, which is linked to disciplinary knowledge, is increasingly seen as outdated and unsustainable. Professional input is increasingly seen as something that comes from outside academia, while academic work is becoming increasingly pushed towards casualized and precarious conditions. Disciplinary knowledge is no longer valued for its own sake, and it is seen as 'unsustainable' when compared to knowledge that can be converted into direct economic value (Trowler, 2012: 28). Despite this, disciplines remain and sit in practical tension with inter and transdisciplinary efforts as they are still at the centre of the academic resource allocation model. Disciplinary units compete with each other for resources (Filho, et al., 2016; Pearson, et al., 2005), and this serves to discourage inter and transdisciplinary efforts.

The concept of 'integral leadership' is useful for transdisciplinarity responses to rethinking higher education's work, focused on leaders' 'integral dispositions'. Integralism is a philosophy that complements transdisciplinary efforts to remedy the fragmentation and over-specialization of knowledge, aspiring toward an alternative future knowledge base that is emergent, yet holistic and comprehensive (Phipps, 2007). Integral leadership aims to foster the capacities for thought and leadership to address complex, messy and 'wicked' problems involving multiple and potentially competing perspectives. A practical perspective from research suggests that integral leadership should focus on its role in encouraging researchers and teachers to take responsibility in processes of societal change. Integral leadership should also seek to resource skilled facilitation processes, allocate defined scope and time for collaborative group building and accord importance to broader social learning (Schauppenlehner-Kloyber & Penker, 2015).

Walker and McLean (2013) complement transdisciplinary insights about the necessity of forming a 'thought collective' for social transformation (Klay, et al., 2014) through their work on the capabilities and the development of higher education for the public good, especially in developing country contexts. Focusing on higher education as the provider of

professional education for the public good, Walker and McLean (2013) examine how professional education might orient professionals to work towards social justice and improve human lives, expanding individual choices and opportunities while contributing to wider social transformation.

A further proposal for integral leadership is to encourage inter and transdisciplinary research and teaching to align with transformational learning processes present within staff development and mandated student learning outcomes. Transformational learning in research and amongst staff and students can be fed into governance processes at the institutional level. While higher education institutions are places where research and learning take place, this does not automatically mean that they function as learning organizations in themselves, nor is it a given that the research and teaching they provide is of the transformative kind. Sustainable development's transformative demand requires that the focus on the big 'why' questions should be given space and avoid being crowded out by the myriad market-based changes to educational policies and practices. The deregulated landscape of roll-back and roll-out neoliberalism (Peck & Tickell, 2002) tends to push fragmented and fragmenting forms of 'solutionism', such as learning technology platforms or management reforms driven by particular commodities, markets and entrepreneurs. Demand-side leadership involves greater recognition for, and re-connection with, higher education's public good roles. External engagement with collective societal challenges should be complemented with internally -oriented collective lear education identities, values and collective capabilities toward the achievement of a more just and sustainable society. Higher education has to manage this outward-facing transformation as it simultaneously looks inward to redefine its own identity, futures and survival, which are nevertheless at stake.

In terms of its recent history, much of the demand for inter and transdisciplinarity emerged from a very critical view of higher education. The rise of specific forms of inter-disciplinary and their critiques of disciplinary knowledge has specific roots in critical social movements with particular emancipatory intents. Dissenting inter-disciplinarians Parker and Samantrai criticise influential scientific perspectives on inter-disciplinarity which demote social justice concerns to secondary status, or obscure them altogether. They find the claims for scientific synthesis and holism to be too apolitical, disregarding the social and intellectual bases of the challenge to academic orthodoxy and ignoring the politics that led to the establishment of interdisciplinary programmes in the first place. The ambivalent politics of contested academic knowledge has deep roots in critiques of the exclusionary and dominating nature of 'scientific knowledge', and to ignore this is to lose a key sense of what it is that has to be transformed. Social movements and countercultural intellectuals have been critical of the institutional roles played by academia in reinforcing inequalities, while pointing to emancipatory hopes that academic institutions could be transformed by social movements to become equalizing forces in society. Some critical scholars have done important work to uncover the messy history of disciplinary norms, and how such norms came to be linked to social inequalities, entangled in lengthy, politicized struggles about whose knowledge is privileged, considered authoritative and allowed to prevail (Parker and Samantrai, 2010). Interdisciplinarity in this sense is an intervention in the microphysics of power, preparing students and researchers not only to enter disciplinary scientific cultures, but to engage in socially-grounded and contestatory relations 'outside those defined by the professions or by capitalist productivity' (Parker and Samantrai, 2010:6). Interdisciplinary fields such as Black Studies, Chicano studies, Asian American studies, women's studies and Native American studies reject the exclusions and domination of an imperialist, white and heterosexist academy. Cultural Studies, postcolonial

and subaltern studies have spearheaded the challenges and formed new centres of interdisciplinary research and engagement. These interdisciplinary fields have tended to represent dissenting, resistant and emancipatory methods and pedagogies.

Resistant and dissenting interdisciplinarians have brought definitive concepts as ‘nature’, ‘economy’, ‘nation’, ‘society’, ‘culture’, ‘politics’, ‘liberation’, and even resistance itself to critique, crisis and renewal. They have sustained the interrogation of these objects and the troubled complicities and assumptions that sustain and regulate them (Parker and Samantrai, 2010). They place at the heart of social justice work a refusal of norms that install modern social hierarchies and the violences that they depend on. They pose questions about the intelligibility of knowledge and the meaning of social justice itself.. Ultimately, interdisciplinarity rooted in critical social justice leads to the critique of its own epistemologies, as well as to a search for new and different ways to link interdisciplinary knowledge and transdisciplinary social action.

In closing, this article aligns with dissenting inter and transdisciplinarians to argue that the critique of disciplinarity should not be naïvely decontextualized. The wider policy context is one in which disciplinary knowledge has already experienced a particular form of transdisciplinarity, domination by neoliberal economics. Neoliberal economics began by assimilating the subfield of development economics, and then spread to dominate the discipline of economics. From there, neoliberal economics has spread through ideology and methodology across the social sciences and permeated into global public policy. This process of transdisciplinary involution has been aptly described as ‘the dull and universal compulsion of zombieconomics’ (Fine, 2009:85). It is complemented by another form of actually existing transdisciplinarity that can be observed in higher education - the transdisciplinarity of quantified control (Burrows, 2012). Quantification that, in the words of Max-Neef, distorts reality, creates confusion and falsifies knowledge. Critically dissenting, public good oriented and socially engaged views of transdisciplinarity challenge the spread of thoughtless, yet ideological quantification and offer alternative and resistant avenues for ‘integrative synthesis’ and the re-orientation of higher education toward sustainability with social justice in mind.

While the challenges of global crises and goal-setting for sustainable development cannot be adequately addressed using our current method of organising knowledge and learning into disciplines (Max-Neef, 2005) according to the Humboldtian system which divided higher education’s knowledge activities into segmented uni-disciplines such as ‘physics’, ‘chemistry’, biology’, ‘economics’, ‘sociology’, or ‘education’, disciplinary thinking and language are not necessarily the problem per se. The global challenges that we face are not disciplinary challenges, they are inter- or arguably trans-disciplinary challenges. Such challenges require different kinds of knowledge to emerge, simultaneously involving many levels and domains of education, learning and research. New kinds of leadership for transformation are emerging, but inter and transdisciplinary projects and instances of integral leadership are currently accorded too little recognition and value. The leadership of higher education must learn to recognise and value inter and transdisciplinarity and practise integral leadership for desirable change to happen.

Transdisciplinarity results from the coordination between hierarchical levels of knowledge, leading to all the levels becoming described in a different way. Max-Neef’s transdisciplinarity is oriented to sustainability in the sense that the transformative demand is ultimately oriented toward the future generations abilities to survive and thrive with the

boundaries of the planet as a whole. The ultimate aim is to construct an economy as if people mattered, bridging the somewhat esoteric language of deep ecology and society's pragmatic and cognitive demands. In terms of epistemology, 'strong transdisciplinarity' is grounded the acceptance of multiple levels of reality, the principle of the 'included middle' and complexity. Strong transdisciplinarity recognizes that the rational and relational modes of reasoning can simultaneously exist, challenging linear and binary logics that would otherwise accord a privileged place to rational and scientific systems thinking while neglecting relational claims for social equity and justice. Disciplinary limitations shape current and dominant conceptions of progress and transformation. This makes transdisciplinarity a challenge, but also a precious opportunity to remake the larger conception of what is an economy in which people matter, and how we might conduct such an economy to include the marginalized groups who seek recognition and resources, while staying within absolute planetary boundaries.

References

United Nations Development Programme, 1994. *Human Development Report 1994: New Dimensions of Human Development,* Oxford: Oxford University Press.

Alvarenga, A. T. d., Sommerman, A. e. & Alvarez, A. M. d. S., 2005. International Congreeses on transdisciplinarity: refelctions on emergences and convergences of ideas and ideals towards a new modern science. *Saude e sociedade,* 14(3), pp. 9-29.

Alvargonzalez, D., 2011. Multidisciplinarity, Interdisciplinarity, Transdisciplinarity and the Sciences. *International Studies in the Philosophy of Science,* 35(4), pp. 387-403.

Barry, J., 2012. *The Politics of Actually Existing Unsustainability Human Flourishing in a Climate-Changed, Carbon Constrained World.* Oxford: Oxford University Press.

Becher, T. & Trowler, P., 2001. *Academic tribes and territories: intellectual enquiry and the cultures of disciplines.* 2nd ed. Buckingham: Open University Press.

Berkeley Haas, 2015. *Strategic Plan: Defining Principles.* [Online]
Available at: http://haas.berkeley.edu/mission/principles.html
[Accessed 15 June 2015].

Bernstein, J. H., 2015. Transdisciplinarity: A Review of Its Origins, Development, and Current Issues. *Journal of Research Practice, Volume 11, Issue 1,,* 11(1), pp. 1-17.

Boulding, K. E., 1966. The economics of the coming spaceship Earth. In: H. Jarrett, ed. *Environmental Quality in a Growing.* s.l.:s.n.

Boyer, E., 1996. The Scholarship of Engagement. *Journal of Public Outreach,* 1(1), pp. 11-20.

Burawoy, M., 2005. For Public Sociology. *American Sociological Review,* Volume 70, p. 4–28..

Burrows, R., 2012. Living with the h-index? Metric assemblages in the contemporary academy. *The Sociological Review,* 60(2).

Carrigan, M., 2015. *The Accelerated Academy.* [Online]
Available at: http://blogs.lse.ac.uk/impactofsocialsciences/the-accelerated-academy-series/
[Accessed 21 October 2016].

Choi, B. C. & Pak, A. W., 2006. Multidisciplinarity, interdisciplinarity, and transdisciplinarity in health research,services, education and policy: 1. Definitions, objectives and evidence of effectiveness. *Clinical Investigative Medicine,* 29(6), pp. 351-64.

CIRET-UNESCO, 1997. *Declaration of Locarno.* [Online]
Available at: http://ciret-transdisciplinarity.org/locarno/loca7en.php

Conklin, J., 2006. *Dialogue mapping: building shared understanding of wicked problems..* Chichester: Wiley.

Dagilienė, L. & Mykolaitienė, V., 2015. Disclosure of Social Responsibility in Annual Performance. *Procedia - Social and Behavioral Sciences,* Volume 213, pp. 586-592.

Davis, W. et al., 2014. Sustainable Knowledge: An exchange. *Socal Epistemology Review and Reply Collective,* 3(4), pp. 11-20.

Filho, W. L., Shiel, C. & Paço, A., 2016. Implementing and operationalising integrative approaches to sustainability in higher education: the role of project-oriented learning. *Journal of Cleaner Production,* Volume 133, pp. 126-135.

Fine, B., 2009. Development as Zombieconomics in the Age of Neoliberalism. *Third World Quarterly,* 30(5), p. 885–904.

Foran, T. et al., 2014. Taking complexity in food systems seriously: An interdisciplinary analysis. *World Development,* Volume 61, pp. 85-101.

Friedman, T. L., 2016. The Age of Protest. *The New York Times*, 13 January.

Frodeman, R., 2014. *Sustainable Knowledge: A theory of interdisciplinarity.* Basingstoke: Palgrave Macmillan.

Funtowicz, S. 0. & Ravetz, J. R., 1994. The worth of a songbird: ecological economics as a post-normal science. *Ecological Economics,* pp. 197-207.

Funtowicz, S. & Ravetz, J., 1993. Science in the postnormal age.. *Futures,* 25(7), pp. 735-755.

Gibbons, M. et al., 1994. *The new production of knowledge.* London: Sage.

Jantsch, E., 1972. Inter- and transdisciplinary university: A systems approach to education. *Higher Education,* 1(1), pp. 7-37.

Khoo, S.-m., 2013. Sustainable development of what? Contesting global development concepts and measures'.. In: F. Fahy & H. Rau, eds. *Methods of Sustainability Research in the Social Sciences..* London: Sage, pp. 91-113.

Khoo, S.-m., 2016. Public Scholarship and Alternative Economies: Revisiting Democracy andJustice in Higher Education Imaginaries. In: L. Shultz & M. Viczko, eds. *Assembling and Governing the Higher Education Instititution.* s.l.:Palgrave, pp. 149-174.

Klay, A., A.B., Z. & Schneider, F., 2014. Rethinking science for sustainable development: Reflexive interaction for a paradigm transformation. *Futures,* Volume 65, pp. 72-85.

Klein, J. & Newell, W., 1996. Advancing interdisciplinary studies. In: J. Gaff & J. Ratcliff, eds. *Handbook of the Undergraduate Curriculum.* s.l.:s.n., pp. 393-395.

Klein, J. T., 1996. *Crossing boundaries: Knowledge, disciplinarities, and interdisciplinarities..* Charlottesville, VA:: University of Virginia Press.

Klein, J. T., 2001. The discourse on transdisciplinarity: An expanding global field.. In: J. Klein, et al. eds. *Transdisciplinarity: Joint problem solving among science, technology, andsociety: An effective way of managing complexity.* Basel: Birkhäuser., pp. 35-45.

Klein, J. T., 2004. Prospects for transdisciplinarity. *Futures,* Volume 26, pp. 515-526.

Klein, J. T., 2010. A taxonomy of interdisciplinarity. In: R. Frodeman, J. Klein & C. Mitcham, eds. *Oxford handbook of interdsiciplinarity.* Oxford: Oxford University Press.

Knight, I., 2016. Today's students were born out of a culture of victimhood.. *The Sunday Times Magazine*, 12 June, p. 7.

Lessman, O. & Roche, J. M., 2013. Collectivity in the capability approach. *Maitreyee: E-bulletin of the Human Development and Capability Association,* Issue 22, pp. 2-3.

Liesenfeld, C., 1993. Inter- und Transdisziplinarität: Heuristik und Begründung. *Journal for General Philosophy of Science,* 24(2), pp. 257-74.

Marglin, S. & Schor, J., 1990. *The Golden Age of Capitalism: Reinterpreting the Postwar Experience.* Oxford: Clarendon Press.

Max-Neef, M., 2005. Foundations of transdisciplinarity. *Ecological Economics,* Volume 53, p. 5–16.

McGregor, S. L., 2015. Integral Dispositions and Transdisciplinary Knowledge Creation. *Integral Leadership Review,* January-February.15(1).

McGregor, S. L., 2015. The Nicolescuian and Zurich Approaches to Transdisciplinarity. *Integral Leadership Review,* 15(2).

McLuhan, M., 1964. *Understanding Media.* Berkeley, CA: Gingko Press.

McLuhan, M., 1967. *Medium is the Massage: An Inventory of Effects.* New York: Bantam Books.

Meadows, D., Meadows, D., Randers, J. & Behrens, W., 1972. *The Limits to Growth: A report of the Club of Rome's project on the predicament of mankind..* New York: Universe.

Mighall, R. (. ,. .., 2008. Rewards for town and gown. *Brand Strategies,* Volume July, p. 34-35.

Millet, D. & Toussaint, E., 2004. *Who Owes Who: 50 Questions about World Debt.* London: Zed Books.

Moran, J., 2002. *Interdisciplinarity (The New Critical Idiom).* London: Routledge.

Neumayer, E., 2010. *Human Development and Sustainability,* Geneva: United Nations Development Programme.

New Economics Foundation, 2009. *The Happy Planet Index 2.0,* London: New Economics Foundation.

Newell, W. H., 2007. Decision making in interdisciplinary studies. In: G. Morcol, ed. *Handbook of decsion-making.* s.l.:CRC Press, pp. 245-263.

Nowotny, H. & Gibbons, M., 2001. The potential of transdisciplinarity. In: J. Klein, et al. eds. *Transdisciplinarity: Joint problem-solving among science, technology and society.* Basel: Birkhauser.

Nussbaum, M. C., 2011. Capabilities, Entitlements, Rights:Supplementation and Critique. *Journal of Human Development and Capabilities: A Multi-Disciplinary Journal forPeople-Centered Development,* 12(1), pp. 23-37.

Oppenheimer, m., 2016. Theology Schools, facing leantimes, look to one another and the Web. *The New York Times* , 18 March.

Oxford University Press, 2016.. *"discipline, n.",* s.l.: s.n.

Parker, J. & Samantrai, R., 2010. Interdisciplinarity and social justice: an introduction. In: J. Parker, R. Samantrai & M. Romero, eds. *Inerdisciplinarity and Social Justice: revisioning academic accountability.* Albany: SUNY Press, pp. 1-36.

Pearson, S., Honeywood, S. & O'Toole, M., 2005. Not yet learning for sustainability: the challenge of environmental education in a university.. *International Research in Geographical and Environmental Education,* 14(3), pp. 173-186..

Peck, J. & Tickell, A., 2002. Neoliberalizing Space (3):. *Antipode,* Volume 34, p. 380–404..

Phipps, C., 2007. Integral politics comes of age. *EnlightenNext,* Volume 38.

Polanyi, M., 1962. The Republic of Science: Its Political and Economic Theory. *Minerva,* Volume 1, pp. 54-74.

Popa, F., Guillermin, M. & Dedeurwaerdere, T., 2015. A pragmatist approach to transdisciplinarity in sustainability research: From complex systems theory to reflexive science. *Futures,* Volume 65, p. 45–56.

Prinsloo, P., 2016. *Curricula as contested and contesting spaces: Geographies of identity, resistance and desire,* s.l.: Research Gate.

Renwick, C., 2016. Biology, social science and history : Interdisciplinarity in three directions. *Palgrave Communications.*

Rittel, H. W. & Webber, M. M., 1973. Dilemmas of a general theory of planning. *Policy Sciences,* pp. 155-169.

Rizvi, F. & Lingard, B., 2011. Social equity and the assemblage of values in Australian higher education. *Cambridge Journal of Education,* 41(1), pp. 5-22.

Rockström, J. et al., 2009. A safe operating space for humanity. *Nature,* Volume 461, pp. 472-475.

Roszak, T., 1969. *The making of a counter-culture: reflections on a technocratic society and its youthful opposition.* Garden City: NY: Doubleday.

Santos, B. d. S., 2014. *Epistemologies of the South: Justice against epistemicide.* Abingdon, Oxon.: Routledge.

Schauppenlehner-Kloyber, E. & Penker, M., 2015. Managing group processes in transdisciplinary future studies: How to facilitate social learning and capacity building forself-organised action towards sustainable urban development?. *Futures,* Volume 65, p. 57–71.

Sen, A., 2009. *The Idea of Justice.* London: Allen Lane.

Shiel, C. & Jones, D., 2016. Sustainability and Social Justice: Leadership Challenges. In: *Assembling and Governing the Higher Education Institution: democracy, social justice and leadership in higher education.* London: Palgrave Macmillan, pp. 11-31.

Sinek, S., 2011. *Start with Why: How Great Leaders Inspire Everyone to Take Action.* London: Portfolio Penguin.

Steffen, W. et al., 2015. Planetary boundaries: guiding human development on a changing planet. *Science,* 347(6223), p. 1259855.

Sterling, S., 2004. Higher education, sustainability, and the role of systemic learning.. In: P. Corcoran & A. Walsh, eds. *Higher Education and the Challenge of Sustainability. Problematics, Promise and Practice.* Dordrecht: Kluwer Academic Press, pp. 47-70.

Trowler, P., 2012. Disciplines and interdisciplinarity: conceptual groundwork. In: P. Trowler, M. Saunders & V. Bamber, eds. *Tribes and Territories in the 21st Century: Rethinking the significance of disciplines in higher education.* London: Routledge, pp. 5-29.

Turner, S., 2000. What are disciplines? And how is interdisciplinarity different?. In: N. Stehr & P. Weingart, eds. *Practising Interdisciplinarity.* Toronto: University of Toronto Press, pp. 45-65.

Vihma, A., 2011. India and the Global Climate Governance: Between Principles and Pragmatism. *Journal of Environment & Development ,* 20(1), pp. 69-94.

Walker, M., 2012. Universities, professional capabilities and contributions to the public good in South Africa. *Compare: A Journal of Comparative andInternational Education,,* 42(6), pp. 819-838.

Walker, M. & Boni, A., 2013. Higher education and human development: towards the public and social good. In: M. Walker & A. Boni, eds. *Human Development and Capabilities: Re-imagining the university in the twenty-first century.* Abingdon: Routledge.

Walker, M. & McLean, M., 2013. *Higher Education, Capabilities and the Public Good: the role of universities in promoting human development.* London: Routledge.

Young, K., 2008. The Minimum Core of Economic and Social Rights: A Concept in Search of Content. *Yale Journal of International Law,* 33(1), pp. 113-175.