

Te Whakatū Kōrero

Working Papers

***Sustainability: The Greening of Education in the
New Millennium***

— Dr Luke Strongman

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Abstract

This paper draws on a range of literature in the field of sustainability to outline the main ways in which sustainability has been defined; explore the central debates within the emergent sustainability movement; trace the interdisciplinary connections between sustainability values in indigenous models, ecopsychology, business and higher education; and synthesise the core principles of sustainable practices for individuals, business and educators.

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Sustainability – the greening of education in the new millennium

Introduction

According to Calder and Clugston (2003), only after the 1992 Rio Earth Summit did the term 'education for sustainable development' (also known as EFS, or 'education for sustainability') enter the vocabulary of educational reformers. They point out that issues of sustainability were first accepted as areas of study in higher education through the influence of non-governmental organisations, business, environmental lobbyists. After the Brundtland report of 1987 by the World Commission on Environment and Development (WCED), government support in the United States, Europe and some developing countries such as Chile and Ghana helped to bring sustainability issues to the attention of academic disciplines and the professions (Calder & Clugston, 2003, p. 1).

In the new millennium sustainability is a critical topic on the political agenda internationally. At the 2009 Copenhagen Climate Conference (COP15 United Nations Climate Change Conference 2009), the New Zealand government announced a commitment of \$45 million to fund a research network to reduce carbon emissions from farming. The Copenhagen research network global alliance will investigate the relationship between agricultural output and greenhouse gas emissions. The New Zealand-led initiative involves a consortium of 20 countries (including The United States of America, Canada, India and Australia) that plan to investigate farming practices and explore the development of new technologies which reduce emissions from livestock, cropping and rice production.

Interest in sustainability as a global movement has grown from the realisation that the world has finite resources, which people may be consuming more quickly than they can replace, discover or invent them.¹

Despite the steady state systems model of Daly (1996, p. 5), according to which the flow of energy in the universe is constant and the increase of entropy in the overall system is negligible, no theories that are based solely on the physical properties of the universe can easily be applied in delivering sustainable societies. O'Sullivan and Painter (2006) point out that in Daly's view sustainable growth is not possible, since the economy is an open-ended system of the

earth's ecosystem, which itself is finite and materially 'sealed off' from the universe except for the sunlight the earth captures, the heat it reflects into space and the gravitational effects exerted in it by other bodies (Adams et al, 2009, p. 7).

However, they consider that sustainable development may be possible by sustaining natural capital through regimes implemented to maintain the biotic economy (O'Sullivan & Painter, 2006, pp. 1–2). As Edward Wilson puts it, 'we [*Homo sapiens*] are the first species to become a geophysical force, altering Earth's climate, a role previously reserved for tectonics, sun flares, and glacial cycles' (1998, p. 277).² Such macroscopic aggregations of the effect of *Homo sapiens* on the environment may be an inspiration for many but, to achieve sustainability, the many have to act in an attempt to change their assumptions and behaviours.

As early as 1934, the architect and writer, Lewis Mumford in *Technics and Civilisation*, had proposed that technology was driven by capitalism, positing three stages in its evolution: The *eotechnic* era characterised by engines made of wood and driven by wind or water power; the *palaotechnic* era which corresponds to the first industrial era brought about by the use of iron and steam-powered engines; and the *neotechnic* era, characterised by the use of synthetics, alloys and electricity (Watson, 2000, p. 288). The current era (or second industrial revolution), sometimes described as the post-industrial era despite its reliance on fossil-based fuels, alloys and synthetics is the most consumptive of synthetic carbon-based resources and the most generative of non-biodegradable waste in the form of 'green-house' gases (discovered by Joseph Fourier in 1824). Writing on the cusp of the era of atomic energy, Mumford's contribution to the sustainability debate arose from his belief that the social and economic organisation of society and its uses of technology were not necessarily aligned, leading to environmental damage.

Sixty years after Mumford, the Stern report (2006) considers that 'Most climate models show that a doubling of pre-industrial levels of greenhouse gases is very likely to commit the Earth to a rise of between 2–5°C in global mean temperatures' (p. 3). It also suggests that a rise of 5°C in global mean temperatures in the period 2030 to 2060 would fall outside of the predicted range of historical tolerances for maintaining the status quo of human habitation on the Earth. The Stern report is a stark reminder that issues of sustainability require understanding, forethought and proactive engagement on a very wide scale. To begin with, then, sustainability needs critical definition.

'Weak' sustainability holds that some substitution between naturally occurring and synthetic resources is tolerable, as long as welfare of people within the ecosystem does not decline, preserving 'optimality' (Beckerman, 1994, p. 195). Daly's (1996) view is that 'strong' sustainability requires synthetic and natural capital to be developed separately (p. 10). Thus there is trade-off between utility and idealism in these two definitions.

The study by Sustainable Aotearoa New Zealand (2009) suggests that the 'strong' sustainability model contains a concentric arrangement of the biosphere (network of biotic relations), the sociosphere (network of social relations) and the econosphere (network of economic relations). The study argues against the scientific viability of what it terms the 'triple bottom line' cultural model (Adams et al., 2009, p. 6). However, it overlooks the psychological and architectural topos of urban infrastructure (the situation in which most people live around the globe), in which sustainable action (and practical difference) occurs at the intersection of the sociosphere, the econosphere and the biosphere.

The model this study offers is precisely the model that industry has followed for decades – one that places the economy as the central hemisphere of a sociosphere within a larger biosphere which, although not wholly characterised by sustainable action, is nevertheless not fundamentally antithetical to it, unless one regards human-made infrastructure alone as the basis of the real economy. The point is that the econosphere and the sociosphere are consuming the biosphere. In the sustainability paradigm we need to draw distinctions between seven forms of capital:

1. natural capital (aquifers, biomass, soil, microbiology, and atmosphere)
2. physical capital (equipment and infrastructure)
3. human capital (embodied skills, services and biomedicine)
4. intellectual capital (information, disembodied skills and knowledge)
5. social capital (formal/informal relations among workers and organisations)
6. financial capital (savings, loans, sale of stocks, sale of bonds)
7. cultural capital (art and design, qualifications, standards, semiology).

'Strong' sustainability is concerned with restoring a balance between all renewable and non-renewable forms of capital (forms one to four) which may require the application of Bourdieu's (1986) forms five to seven.

O'Sullivan and Painter (2006) point out that, while most international assessments have concluded that resource depletion is endemic and waste assimilation pandemic, in some areas of society there is little concern at the individual level. This lack of interest leads to inadequate provision of programmes for education for sustainability in the environmental politics of many Western economies. In New Zealand, for example, while engineers have long recognised a responsibility to maintain the biosphere, sustainability issues, have latterly been recognised only by the Resource Management Act 1991 (RAM) and in policy statements such as the Sustainable Development for New Zealand Programme of Action (Ministry for the Environment, 2003), the Sustainable Water Programme of Action (Ministry for the Environment, 2009) and the work of Sustainable Aotearoa New Zealand (SANZ).

To do the concept of sustainability justice in a post-Brundtland pluralistic world, insight into both sustainability issues and strategies for remedying them is required from a variety of disciplines, perspectives and methods. We need to examine more closely the interaction between societal structures and human behaviours, as well as new possibilities for demographical organisation, systems of socialisation, economic production and ordered patterns of consumption in the environment that address sustainability issues. Sustainability as an interdisciplinary field includes the following disciplines: economics, engineering, humanities, anthropology, sociology, psychology, architecture, geography, agriculture, planning, and legal systems. As Dr Kate Hewston (personal communication, February 2, 2009) states, sustainability involves the systematisation of the relationship between reductionism and holism with regard to social, economic and environmental constraints. As such, there is a need – as O'Sullivan and Painter (2006) explain – to 'move away from the "command and control" paradigm', not towards a streamlined, status quo 'more market' approach, but towards individual and collective recognitions of people as participants in a 'self-organising' system (p. 13).

Ecological systems are characterised by energy flow, interdependence, adaptation, cycles and diversity. In any 'strongly' sustainable system there is a freeflow in which relationships between constituent parts are nurtured to produce a steady-state economy, in which the aggregate throughput of matter and energy over time is constant. Concomitant with this is the realisation that individuals and populations do not live apart from nature but within it, in symbiotic and other relationships that all use energy and biotic materials, forming an ecosystem.

As far as education is concerned, sustainability is usually associated with three concepts – environment, economics and the concept of society. The following considerations may apply to the syllabus for education for sustainability:

- green policy and practice
- education for change – awareness and behaviour
- communication and planning
- business efficiencies and distribution of resources
- time management, management of resources
- human needs and human rights
- law and governance
- local knowledge and scientific knowledge
- interdisciplinary subject-content
- ‘green’ awareness in pedagogy
- links between the community, the professional sector and industry
- the need to make ethically positive, active choices about sustainable practices.

Thus definitions of sustainability are, in principle, broad and encompass these fundamental dimensions. At the core of the sustainability movement, within its strategies for preserving a life-sustaining biosphere, is human development.

Definitions of sustainability – a spectrum of policy positions

The Brundtland report (World Commission on Environment and Development [WCED], 1987) describes sustainability as ‘meeting the needs of the present without compromising the ability of future generations to meet their needs’ (p. 1). Defined in terms of economics, sustainability is a measure of ‘non-declining per capita utility between inputs of three resource forms: labour, capital and natural resources’ (Moffatt, Hanley, & Wilson, 2001, p. 75).

Within the politics of sustainability there are tensions between the supporters of sustainable transformations and those who see no need to act, or are satisfied with the status quo. These views may be expressed as a continuum with individual freedoms at one end and governmental control at the other – from the ‘natural’ needs, actions and wants of ‘human nature’ as an aggregate of free-thinking individuals, and planned development and organisational control. From an economist’s perspective, natural and man-made capitals are substitutes; they are frequently not differentiated in economic terms, and neo-liberals may believe that environmental problems can be overcome by investing financial capital in innovative technology. Technological sustainability allows development in the form of qualitative improvement (such as new technical solutions or changes to environmental problems caused by the application of new knowledge). To return to an economic focus and use a metaphor from Alan Greenspan (2007), sustainability may involve the ‘creative destruction’ of the old model of environmental depletion, and its replacement in a naturally occurring generative sense by the new model of sustainable practices. Isn’t this precisely what nature does, by working in cycles?

As a counterpoint to theories of economic sustainability, Beck (1982, p. 6) identifies the so-called radical ‘red-green’ literature (the two colours represent frequencies of energy consumption), which holds that capitalism systematically undermines environmental sustainability. Ecological disruption is an inevitable consequence of the way in which society is organised under the profit motive of capitalism (if not neo-liberalism itself). This is also the fall-back position of the environmentalist movements whose advocates claim that human society creates a ‘metabolic rift’ in the environment in which systems are overloaded and cannot cope with waste generation. A ‘treadmill’ is created in which businesses are constantly required to expand to make profits, and government subsidies in the form of tax breaks support business expansion while employees are coerced into political agreement to keep their jobs. Some of the resultant capitalist gain comes at the expense of the environment.

At the macro level, Wilson claims that the current loss of biodiversity is the greatest since the end of the Mesozoic era, some sixty-five million years ago (Wilson, 1998, p. 294). It is possible that the environmental damage caused in the twentieth century to the diversity of non-human biota will require millions of years to restore. Historians of the twenty-second century may look back on the current era with dismay (if they are able to).

Similarly, others claim that objectivist science has been harnessed to meet vested interests of business groups. The Danish environmentalist Bjorn Lomborg (2001) has thrown doubt on the extent to which human civilisation has influenced climate change, forcing others to ask what constitutes proof of climate change and whether science is itself a construct that may be used for political ends. Others, such as the former American Vice-President Al Gore, argue that these sceptical counter-beliefs distract attention from inconvenient truths about the consequences of the impact of human society on climate change (Gore, 2006) and dissolve focus from more practical environmentally sustainable solutions.

Sustainable development requires that the rate of depletion of non renewable resources should be restricted to a level whereby their use should foreclose as few, and keep open as many, options for the future as are possible (WCED, 1987, p. 3).

Strong, sustainable development rejects the idea that natural capital and man-made capital are interchangeable. The preferred option is an acceptable balance between the production and consumption patterns of human society in natural ecosystems. Unsustainable development is founded on the attitude, often held in ignorance, that the world and its resources are a giant open system and that it is a human 'right' to deplete natural resources while polluting the environment and producing goods that end up as waste.

However, as Karl-Henrik (2002) points out, natural cycles surround society and comprise the parameters of life in whatever form (p. 61). Sustainability is dependent on natural flows from nature's production and the biosphere and materials from the Earth's crust. If everything is made of atoms that were dispersed 3.5 billion years ago and have organised themselves into concentrated structures that form the biota of the biosphere, the aim of sustainability is to treat this natural flow as a form of 'interest rate' from nature, rather than as a toll on its underlying capital (Karl-Henrik, 2002, p. 61). Karl-Henrik's concept of 'interest rate ecological sustainability' is similar to Eckersely's notion of 'free market environmentalism and McAfee's imperative that 'nature be sold to save it' (Clark, Massey, & Sarre, 2006, p. 121).

However, the Brundtland report (WCED, 1987) holds that the neo-classical economy model applied by the main industrial powers is inexorably unsustainable and detrimental to the long-term health of the planet. The report identifies the over-use of environmental resources as the cause suggesting that economics and ecology bind us in ever-tightening networks, necessitating increased cooperation and policies that sustain and expand the Earth's resource base. The Brundtland report identifies limitations that our current state of technology and social organisation impose on the ability of the environment to meet present and future needs. In this context, the term 'ecological footprint' refers to the amount of productive land required to support society with available technology. It is expressed by the 'PAT' formula: Population size multiplied by per capita affluence (consumption) multiplied by the application of technology used in sustaining consumption (Wilson, 1998, p. 282). This is different from the 'carbon footprint', which is a measure of fossil fuel consumption per capita, offset by the available carbon sink from photosynthesis in the ecosystem. The 'food fork' is the percentage of arable productive land divided by the rate of population growth.

Within the sustainability paradigm, three separate but interrelated movements take significance. The first of these is the 'Gaia hypothesis', formulated by James Lovelock in the mid-1970s. Founded on the holistic principle that Earth is a living entity and that separation between humanity and the environment is 'arbitrary' and anthropomorphically biased, Lovelock's hypothesis conceives 'Gaia as a complex entity involving the Earth's biosphere, atmosphere, oceans and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet' (Lovelock, 2000, p. 10). As such, he views the Earth's ecosystem as a 'living equilibrium' governed by 'homeostasis' (p. 10). Affirming the Gaia hypothesis means recognising that human relations are intrinsically connected to the natural world.

The second is the 'deep ecology' movement, which views humanity as arising from and ultimately only compatible with the tolerances of the natural ecosystem. The concept of deep ecology originated with the Norwegian philosopher Arne Naess, who posited seven principles of grass-roots ecocentricism. These principles are:

1. *Rejection of the human-in-environment image in favour of the relational, total-field image.* This principle holds that it is only by examining humanity in relation to the totality of life forms and life systems that anthropocentric behaviour may be corrected.
2. *Biospheric egalitarianism.* According to this principle, respect for all forms of life on earth is a basic tenet and value.

3. Principles of *diversity* and *symbiosis*, involving a broad-spectrum approach to the potential for life, the preservation of genetic culture and the plenitude of life forms.
4. *Anti-class posture*. This principle seeks to neutralise group conflicts and eliminate the pressure points and bottle-necks of unequal resource consumption.
5. *Opposing and eliminating pollution and resource depletion*. This principle is exemplified by the Kyoto Protocol and the reduction of CO₂ emissions.
6. *Complexity, not complication*. This tenet involves realistic and nature-enhancing solutions to environmental problems. It emphasises systems thinking rather than fragmented approaches to environmental problem solving, and actions that are integrated within sustainable practices.
7. *Local autonomy and decentralisation*. This principle, asserted largely before the globalisation movement of the last quarter of the twentieth century, affirms value in the strengthening of local self-government and material and mental self-sufficiency. (Naess, (1973), pp. 3–6).

The third movement of increasing significance in the sustainability paradigm is 'Ecofeminism'. If 'deep ecology' is concerned with correcting the biases of the anthropocentric duality of humans and nature that lead to anti-ecological beliefs and practices, then ecofeminism focuses on andocentric man/woman relations. The argument stems from the age-old Aristotelian division that sees women as being connected with nature and exhibiting dionysic and emotional qualities, while associating men with the non-material, the rational and the apollonian. Thus ecofeminism seeks to identify, critically examine and correct environmental injustices that result from the unthinking application of these gender-divisive views to the human world.

Any sustainability solution requires a progressive transformation of economy and society, to achieve social equity between generations, provision for the basic needs of all, opportunities for people to satisfy their aspirations for a better life, and the achievement of sustainable consumption patterns. It requires economic growth in places where people's basic needs are not being met, the provision of equal opportunities, demographic organisation in harmony with the changing potential of the ecosystem, and the cessation of all forms of over-exploitation – including over-exploitation of water reserves. According to Wilson (2008, p. 284), by 2025 over 40 per cent of the world's population will be living in regions of chronic natural water decline.

A litany of ecological policy objectives in response to increasing pressures from environmental depletion would seemingly rate highly on any liberal politician's public-good wish list, but achieving change in social organisation, economic practices and attitudes towards the environment is incredibly complex in practice. To begin with, there is frequently a communication gap between environmental lobbyists and emerging assistance groups, who may be unaware of their common interest and potential combined power. More frequently, there is simply a disconnection between political objectives and economic realities in nation-states (particularly of in the developing world), as well as a lack of education for change (WCED, 1987, p. 3).

One myth is that sustainability requires a reduction in consumption and a lessening of the quality of life. In fact, the first stage of sustainable practices requires growth, but growth of a different order – an enhancement of a different quality of life in order to make material- and energy-intensive practices more equitable in their impact. Advocates of sustainability maintain that rapid growth combined with deteriorating income distribution may be worse than slower growth combined with redistribution in favour of the poor (Brundtland, 1987, p. 3). The question then becomes: Can sustainability be characterised in terms of social class and socioeconomic inequality? The people who currently have the widest range of choices in lifestyle (for the most part, those in the developed world) also have the most freedom to make a difference by choosing sustainable lifestyles. Scratch the surface of environmental activism and many sustainability movementists believe that industrialisation tends to simplify ecosystems (as well as degrade their quality), reducing the diversity of species. New models of post-industrialisation need to accentuate diversity and broaden the range of economic variables to satisfy human needs and aspirations by adjusting to scarcity through greater efficiency in the use of natural resources and finding bio-sympathetic substitutions. However, the counterpoint to environmental degradation has been a stockpiling of biota, including genetic materials. In this context, Parry (as cited in Clark et al., 2006, p. 120) has pointed out that since 1980 'the world has witnessed the most significantly concerted ... accumulation of biological material since the nineteenth century'.

As a movement of intellectual trans-nationalism, sustainability defies national boundaries, but there are insuperable tensions between the economies of profit and the economies of sustainability. Ironically, it is the developing world that is the greatest consumer of raw resources, while frequently demonstrating the fewest sustainable practices under the perpetuation of the neo-colonial paradigm. A sustainably literate first world can educate the developing world through sustainable economic intervention, through technology and by development, in the form of sustainable infrastructure requiring an ideological involvement in sustainable practices, which extends beyond the

repatriation of economic loans. It may do this by lobbying on the part of non-governmental organisations, by applying other forms of political and diplomatic pressure, and by its purchase choices in the market-place. At the grass-roots level of application, examples of practical measures for developed societies include waste sorting, eco-planting, solar panels and wind farms, alternative energy sources, and the diversion of a proportion of industrial profits to the environment. Green mileage charges on air flights, the energy savings on eco-bulbs, and the use of hybrid cars are seen as the most likely small-scale solutions that aggregate into larger sustainability gains. These work in conjunction with technological invention and green management planning. Health care is also vastly dependent on ecology – 80 per cent of the world's inhabitants still rely on traditional plant medicines for primary health care, and 25 per cent of prescription drugs contain extracts derived from plants (Clark et al., 2006, p. 122).

As well the use of new technologies to achieve social goods, education may be used to define regimes of sustainable human development and becomes a powerful tool for critiquing, disseminating and archiving sustainability principles and practices. Objectives of sustainable development and environmental protection must be built into the mandates of the institutions that work in environmentally sensitive areas. The aim is to generate knowledge and expand the radius of influence of education for sustainability to create a base that fosters self-reliance. Concomitant with this is the need to establish a social system that provides solutions for the tensions that arise from disharmonious development. Such an administrative system needs to be flexible and have the capacity for self-correction. It may also require autopoietic qualities (that is, be self-organising, with no inherent limits on its duration).

In exploring society and nature from a sociological perspective, Meadows, Meadows, Randers and Behrens (2005) ask whether there are physical and ecological limits to the expansion of the human population. One of the core issues of the Brundtland report (WCED, 1987) is to explore the notion of 'our common future' and in the context of 'sustainable development' to determine whether and to what extent the current generation is creating an environment that threatens the lives of future generations. However, in 1987 when the Brundtland report was published it was thought that the assumptions behind the 'limits to growth' hypothesis would be ethically untenable. Strategists held the view that an ever-increasing population is not the real problem, but rather the emphasis that Western society places on materialism and consumption. In a nutshell, the problem can be reduced to the question of whether the main issue is the lack of resources in general, or whether the basic problem is that those scarce resources are held by the consumptive elites. These considerations involve two main factors – effective citizen participation in decision making

(and human rights), and the search for new solutions, including technological innovations and new organising principles for distribution of (and access to) resources. Edward Wilson defines two contradictory human attitudes in environmental debates. The first is a 'naturalistic' image in which humans are cradled within a 'razor-thin' biosphere and are constituted in an organic 'habitat evolution'. The second is the 'exemptionist' view (which originates in the Christian interpretation of the Book of Genesis in the Bible), that *Homo sapiens* exists apart from nature and controls it, and humans can 'take or leave' the ecological view (Wilson, 1998, p. 278).

It has also been claimed that sustainable development is an 'oxymoron' under a 'managerialist paradigm' (Sveiby, 2009, p. 5). Yet many management programmes adopt a utilitarian approach to business innovation. Sustainability must be seen as more than part of an emerging paradigm of change, and as driven by informed necessity rather than cosmetic or fashionable appeal. Yet where else may sustainable views as a term for a set of attitudes that have underlying values be applied? How can these adapted to business and education? Can society create sustainable economic and social systems, as well as sustainable teaching and management practices? Where can people turn to find some building blocks for models of sustainable practice?

Indigenous models

Drawing on native Canadian Indian custom, Sveiby (2009, pp. 8–15) points to at least twelve aboriginal principles for sustainable development. These may be divided under categories of ecology, social factors and economy:

1. *Ecology:*

- Keep all alive.
- Do not stay only in one place (do not put all your eggs in one basket).
- Do not deplete the breeding stock.

2. *Socialisation:*

- Do not impose your views on others.
- Share the knowledge.
- With knowledge comes responsibility.
- Divide the roles.
- Behave with responsibility to other communities.
- Punish only your own.
- If you break the law, you carry shame.
- Build respect.
- Maintain equitable power structures.
- Everyone has a role.
- Build community.
- Do no harm.

3. *Economy:*

- Knowledge is a primary resource.
- The economy has tangible and intangible parts – both are valuable in establishing quality of life.
- Respect diversity.
- Do not sell products and services of low value.

These general principles of environmental, social and economic behaviours and practices are coupled with concerns about the management of local resources, the stewardship of biodiversity and the validity of local knowledge, all of which may complement scientific knowledge. However, it takes a shift in perspective for many schooled in the late twentieth-century and early twenty-first-century Western education system to trust the validity of knowledge acquired from sustainable use, rather than from empirical experiment and abstract deduction. In fact, two threats to some sustainable practices that require the expenditure of time and energy in terms of re-organisation from a sustainability perspective are what are perceived as dogmatic and coercive education strategies concerned only with throughput efficiencies, and business practices that place profits over the welfare of the environment (applicable to problems of waste disposal, for example). Similarly, the 'holistic' management styles favoured by indigenous peoples in the sustainable paradigm mean more than recognising the 'sum of parts' of human interactivity with the environment. Rather, they require knowledge of the interrelationship between the parts. Holism is not a term associated with vague mythology, but rather a call to recognise the complexity in systems.

Traditionally schooled aboriginal people see the environment as a complete system whose constituent parts are interconnected in a seamless web of causes and effects, actions and outcomes, behaviours and consequences, in which the past is linked with the present. People, animals, plants and natural objects are not necessarily separate and distinct, but rather are linked and interrelated in a habitat. However, we must remember that indigenous peoples themselves are diverse the world over and their knowledge generation and sequestration is not entirely homogenous.³ Indigenous habitats are different in different regions. Nevertheless, the culture of the developed world has much to gain from collaboration with different indigenous traditions, methods and techniques, not least values and attitudes that represent local knowledge of the management of food production practices, traditional medicines and the preservation of the genetic diversity of biota. Concepts about the usage of resources, attitudes towards human interrelation, communication and the exchange of knowledge and information, and techniques, strategies and rationales for sustainable practices may involve a confluence of Western techniques and indigenous societal lore in which there is a dialectical relationship between the practices and belief systems of different ethnic groups.

Four overriding sustainability principles from indigenous cultures are:

- respect for all life forms
- not to waste through play

- inter-generational knowledge, lifelong learning
- interconnectedness.

According to Tipene (Tipene, P., personal communication, January 28, 2009) kaupapa Māori offers several principles for the guidance of sustainability in Aotearoa. These may include: a belief in *mauri* (a core essence or life force), the presence of *atua* (or custodians), the concept of *whanaungatanga* (belonging instead of owning), *whakapapa* (the lineage that connects Māori to every aspect of the universe and each other), *matauranga* (knowledge and understanding – the concept of knowledge as identity, history, customs, genealogy and mythology), and *kaitiakitanga* (conservation and protection) (Jacobs et al., 2008). Tipene suggests that these generic concepts provide reference points for developing frameworks for self-sustainable landcare and community resources. As part of the Integrated Māori Land and Resource Development: A Decision-Support Framework ('Iwi Futures') project of Massey University, Tipene suggests that kaupapa Māori emphasises the integration of a variety of cultural tools and practices, which may include te reo (language), knowledge, people and land. These tools may be developed as methods of advancing economic, social, and ecosystemic integration and fostering self-reliance. Principles and values underlying Māori sustainability include: respect and caring (*kaitiakangā*), recognition of common interest (*whakapapa*), acceptance of responsibility (*tino rangitiratanga*), persuasion and empowerment (*manakitanga*), inclusiveness (*whanangatanga*), and equity (*oritanga*).

Ecopsychology

Ecosystemic integration and self-reliance are also characteristics of the emerging discipline of ecopsychology, which is underpinned by a belief in the reciprocity of human–earth coexistence. The central tenet of ecopsychology assumes that it is psychologically damaging for humans to live in ways that are disconnected from their ecological context. At a person-centred level, ecopsychology is primarily concerned with methods of healing the disconnection of people from their ecological context, through therapeutic techniques that involve such practices as mindfulness, daily ritual, heightened awareness, wilderness experience and the development of a sense of place. These may be combined to produce ecological embeddedness – thus relieving symptoms of depression, stress, anxiety, longing and grief. Ecopsychologists believe that mindfulness, the practice of being environmentally aware in the present situation (wherever that may be), contrasts with the fragmentary demands placed on people’s attention in fast-paced industrial society, and is one method of remaining ecologically connected. Interconnectedness at the individual level and a belief in the value of connectedness are relevant for sustainability, because reconnecting humans to nonhuman nature is a step towards ‘healing the planet’. Above all, ecopsychology attempts to remedy the anthropocentric stance that controls and objectifies nature regardless of human needs, exploring and neutralising pathologies of destruction and disconnection.

At the other end of the spectrum of human and environmental utility / disconnection and conservation / connection, Edward Wilson (1984) defines the ‘biophilia hypothesis’. Wilson’s hypothesis holds that humans have an innate affinity for nature, stemming from an ancestral past in which humans arose from the natural environment. Its antithesis is the ‘biophobic’ attitude born of ignorance, which separates humanity from the natural world and which ecopsychologists believe may be corrected by a nature-immersion experience. Ecopsychology is guided by a desire to encourage a human bond with bioregions, which provides a sense of belonging and motivates earth-friendly behaviour.

Along with person-centred mindfulness, ecopsychologists advocate the wilderness experience (as proposed by Thoreau and others) as a means to ecological connection. This practice is augmented by adventure-challenge pursuits, which boost self-esteem, connection and confidence through a sense of accomplishment at problem solving and overcoming physical challenges in natural environments. Interestingly, an orientation towards materialistic values (which focus on image, money, status and possessions) tends to be negatively

correlated with subjective well-being. This may be because consumerism and materialism are associated with individualism, which is at odds with collectivist values.

Ecopsychology also questions the relationship between phenomenology and empiricism. Exponents question the pursuit of logical-positivist inspired science, which has the corollary of estranging people from direct human experience. To regain a sense of mindful, ecologically connected physicality, ecopsychologists advocate perceptual awareness through a number of techniques, including (Scott & Koger, 2005, pp. 5–6) ‘splatter vision’ (which aims at widening the perceptual field), ‘small world’ (which focuses on enriching perceptions of environment), ‘focused hearing’ (the identification of sounds in an environment), the ‘blindfold walk’, the ‘human camera’, and the ‘drum-sick blindfold walk’ (which all increase perceptual capacity), and ‘scent trail tracking’ (following a natural path according to smell). Ecopsychology had its origins in the 1980s with the ‘Council of beings’ – a group designed by John Seed and Joanna Macy (early exponents in America of the deep-ecology movement) as a re-earthing workshop to help participants experience connection to the natural world, both emotionally and spiritually.

Business and sustainability

Sustainability is at its most contentious in the business environment. Despite the presence of strong regional, national and international sustainability lobbying groups (such as SANZ), the increasing concern of many Western governments to address issues of sustainability through national programmes of education and legislation, and the growing presence of green agriculture, green energy and a green consumer culture, it is very difficult to 'proof' the consumer-driven, profit-motivated economy with sustainability issues and practices. The methodological basis of business recalcitrance towards sustainability is logical positivism, and concomitant philosophies of political scepticism such as those of Karl Popper, who in *The Open Society and Its Enemies* (1945) claimed that 'open' societies such as Western democracies, with their cornerstones of individual freedom, market economy and competition, cannot implement solutions from what he terms 'closed' societies, such as primitive societies (which they 'surround'). However, Popper's goal was to preserve democracy from dictatorship, not to assess the positive qualities of aboriginal societies. His use of the pejorative 'primitive' was largely reserved for European political abuses.

Nevertheless, exponents of sustainable practices argue that the traces of political ruthlessness are carried over into neo-liberal industrialisation, in which a growing public awareness of a 'green economy' is countered by entrenched patterns of supply and demand for resources under the profit motive. In steering business towards a greener path, financial incentives and disincentives (including eco-taxes and tradable permits) that encourage and discourage kinds of economic behaviour may be preferable (O'Sullivan & Painter, 2006, p. 14).

Sustainability advocates all point to the fact that the economic system is often perceived as independent of ecology, and interventions are often perceived as 'anti-growth' – therefore anti-business. However, the economy, including the paradigm of the creative industries and the post-industrial stock markets (such as futures), if it is located in physical space, is located in the confines of the ecosystem and cannot be separated from it. O'Sullivan and Painter (2006, p. 16) also consider the common belief that protecting the world's climate would *necessarily* have to be costly to be undemonstrated and questionable.

Elliot (2005, pp. 1–9) defines eleven factors that call into question the efficacy of sustainable business performance:

- Concern for sustainability issues is high, but the strength and depth of attitudes (level of belief) is low, which accounts for the perception that the rate of progress towards a culture of sustainability is less than desirable.
- Current methods of categorisation of consumers may be under-estimate the level of commitment to sustainability, by measuring low levels of activity rather than underlying attitudes to behaviour.
- Questions that are biased in their formulation are inflating positive and negative responses.
- While levels of concern are high, in practice sustainability issues are not necessarily the highest priority for the general public, which means that potential activities that promote sustainable practices may be subordinated to other concerns.
- People in the corporate environment have no special access to information on sustainability.
- The level of debate about sustainability issues is uninformative – one-sided arguments, vested political interests and exaggeration for effect all devalue the strength of the sustainability case.
- Information, though widely available, is not very accessible and many ingredients for cultural change are largely absent. If the level of belief is low, there is no effective feedback on achievement and there may be contradictory advice on appropriate actions and a lack of role models. It is hard to make the emotional connection that is needed for change to take place.
- People are unconvinced – they are fed up with an unfulfilled ‘fear’ message.
- The green agenda is so vast and there are many issues over suitable terminology for describing it. Green labelling is confusing, rather than helpful, and may be applied indiscriminately.
- In purchasing decisions, product benefits from sustainability are usually secondary to the main evaluation criteria.
- Marketers need to take a more holistic view. This doesn’t mean seeing a totality, but not losing focus on the small things that matter.

However, Elliot claims that in most cases marketing based on a green or socially responsible platform remains ineffective. As he points out (2005, p. 6), companies tend to operate in one of three ways:

1. at low cost, with well defined efficiencies, levels of service, deliverables and price platforms
2. with differentiation, defined by particular characteristics that add value for the customer, resulting in improved prices but pressure on margins as added costs
3. with market focus, a company targets a customer segment with selected characteristics to meet niche demand.

Often businesses have conflicts between providing minimum costs to consumers who buy on price and continuing to develop differentiating factors that may not be properly remunerated. The risk is that sustainability is seen as a differentiated consumable, resulting in a so called 'green-wash-syndrome' attributed to packaging and advertising rather than applied throughout the business organisation's management system as a guiding philosophy for best practice or the composition of the end products (Elliot, 2005, p. 8).

There is also an element of relativity in the debate about the efficacy of green business. Surveys may be designed to produce different results, depending on business and political interests. For example, the US-based Natural Marketing Institute's 2007 LOHAS Consumer Trends Database reports a growing impact of consumer confidence in environmentally concerned business, but does not state whether its survey relies on a data pool of environmentally concerned consumers or is based on results from a set taken at random.⁴

Daly's (1996) rule for sustainable economic resource activity may be of more theoretical import than Elliot's assessment of market opinion is. As O'Sullivan and Painter (2006, p. 10) summarise, Daly's view is a form of 'input-output model', in which economics is directly related to the ecosystem. The *input rule* holds that:

1. harvest rates of renewable resource inputs should fall within the regenerative capacity of the natural system that generates them
2. depletion rates of non-renewable resource inputs should be equal to the rate at which renewable substitutes are developed by human intervention. Any proceeds from sale of non-renewables should include research in pursuit of sustainable substitutes.

The *output rule* holds that waste emissions should be within the assimilative capacity of the local environment to absorb, without degradation to its capacity to continue to do so (Daly, cited in O'Sullivan & Painter, 2006, p. 10). The attractiveness of Daly's model is that it is eminently practical at the local level, and also applicable within straightforwardly measurable parameters. However, others have also developed sustainable business policy statements.

Paul Hawken (1993, pp. 14–15) identifies eight principles and goals of sustainable engagement and development in business practices. In brief, these principles and goals are to:

- reduce absolute consumption of energy and natural resources in the industrial north by 80% within the next half-century
- take steps to provide secure, stable and meaningful employment for people everywhere
- be self-actuating as opposed to regulated or morally mandated
- honour market principles – recognise that sustainable practices may not work if they require wholesale change to dynamics of the market. it is unlikely that people will respond to being asked to pay more to save the planet
- be open to the fact that sustainable practices may lead to societal rewards of a different qualitative form from the present way of life
- exceed primary sustainability objectives by restoring degraded habitats and ecosystems to their fullest biological capacity
- rely on current income
- be fun and engaging, and strive for an aesthetic outcome.

Hawken further suggests six practical steps for ecological commerce, or how business can save the planet (1993, pp. 14–15). In summary, these are to:

- replace nationally and internationally produced items with products created locally and regionally
- take responsibility for the effects they have on the natural world
- do not require exotic sources of capital in order to develop and grow
- engage in production processes that are human, worthy, dignified, and intrinsically satisfying

- create objects of durability and long-term utility whose ultimate use or disposition will not be harmful to future generations
- change consumers to *customers* through education.

These basic concerns may take their place in a wider debate about the benefits or disadvantages of globalisation (the internationalisation of business practices). They are straightforwardly positive tenets, although elaborate systems may need to be devised to apply them. However, in the first decade of the twenty-first century, there is also an increase in lobbying for international sustainability standards and collaboration among businesses over sustainability issues. For example, a national industrial symbiosis programme has been launched in the UK and there is a growing movement towards corporate responsibility in America and the European Union following the global recession of 2008 (Waddock, 2008, p. 87).

The media profile of competing business concerns may be inherently tied to political concerns that may form a company philosophy, entailing a position on sustainability. Historically, people of liberal and democratic political leanings have favoured green business while those of a conservative and republican persuasion have ignored it. Furthermore that under conditions of globalisation, the transnational production and movements of goods and services results in networks of supply and demand so varied and diverse that sustainable practices and products may make up only a small fraction of these. Underlying many national business conglomerates are government subsidies that support business expansion to maintain tax revenue. employees of businesses in turn support expansion to keep jobs, but the consequences are income disparity and often environmental degradation.

If in the Western neo-liberal view the global movement towards sustainability is informed by the systematic proliferation of sustainable management practices combined with the ecological knowledge of indigenous cultures, it may be unrealistic to place too much emphasis on local culture, and yet the sustainability movement cannot overlook either national and international interests, or local or community interests. The tension between homogenisation and diversity applies on all economies of scale. Sustainability has to be an inbuilt part of consumer choices, not just a vague ideological preference.

However, more and more business advice is offered from mandates for sustainability. Sustainability is also becoming synonymous in business planning with long-term success. The present UK government's business advice and support service Business Link identifies 17 factors for sustainability in business

in its list of title guides (Business Link, 2009, pp. 1–4). The headings of these title guides may read like imperatives of the practical sustainability movement and confirm the relationship between the economy, society and the environment:

- Save money by reducing waste
- Save money by using energy more efficiently
- Your responsibilities for the environment
- Importance of environmental issues to your business
- Set up an environmental management system
- How to manage waste effectively
- How to prevent water pollution
- Protect employees and the environment from air pollution
- How to use environmental assessment techniques
- How to make your supply chain greener
- Your responsibilities for health and safety
- Use resources more efficiently
- Grow your business through sustainable innovation
- Provide sustainable goods and services
- Corporate social responsibility
- Ethical trading
- Create a strategic approach to sustainable development

In these guides, sustainability applies to values, attitudes, processes, practices, people, goods and services, communication and transportation. However, sustainable business practices may also have deeper ecological connections in the context of appropriating designs from nature and natural systems. Quite separate from the fact that human emotions may correspond to physical states in nature, the concept of biomimicry or biotechnics points to ways in which sustainable technology can be designed and engineered from the implicate order of nature.

As Benyus (1997) points out, biomimicry uses nature as a model. It is innovation based on patterns discovered in nature and adapted into designs and processes that solve human problems. Examples are the solar cell (inspired by a leaf design), suspension bridges (inspired by skeletal structures), velcro (inspired by grappling hooks on seeds), and even computer inter-connectivity (mirrored by hymenopterac society). The concept also involves nature as a measure of human endeavour, with the tacit knowledge that natural designs have evolved over 3.8 billion years and (despite the second law of thermodynamics, which the physicist Schrödinger had identified in 1943 as being quite separate from life forces) are, to some extent, reasoning from induction – therefore, self-sustainable in evolutionary terms.

Biomimicry may be applied to resource management systems as well as to technological inventions. An example is the cleaning of water systems by the water's passage through ponds of gravel and reeds, as in Wellington City's Waitangi Park in New Zealand. The final cornerstone of biomimicry is the need to study and learn from natural designs and systems in new ways, asking not only what can we extract from nature but what can we learn and apply from it.

Market-based solutions?

Green consumerism holds that market processes and the consumption decisions of millions of individuals can themselves create an environmentally sustainable society. A central idea of the market economy is that as one kind of resource starts becoming scarce, its price will go up. Yet many sustainable resources, some of which we might take for granted (such as water, air and food), are needed by all. As we already know, the quality of life is uneven over much of the world. Western society can play a leadership role in sustainable business practices and at the same time teach and provide innovative technologies for sustainable systems in the developing world. The alternative will be a doomsday scenario of societies that are politically organised for the predation of basic human resources.

A counterpoint to this is the unproven belief that the open market may be a self-balancing system. If the market is analogous to ecological systems themselves, can solutions be found by relying on local knowledge and the intelligence of individuals rather than on state intervention? One libertarian theory expounds a form of 'hands off' intervention on the lines of Adam Smith's notion of the market delivering a regulated economy by means of the 'invisible hand' of supply and demand. Yet it is easy to see this as an excuse for the individual to

do nothing. How viable is the concept of effortless 'ecological modernisation'? Science and technology may have been responsible for getting modern societies into a poor environmental state, but with education for sustainable practices they are equally capable of getting societies out of that state into a new environmentally stable modernity. Under a regime of ecological modernisation, environmental standards may gradually be raised (Beck, 1982, p. 3). An example of 'ecological modernisation' is the business movement towards 'green products'. These include organic products whose manufacture is achieved through environmentally friendly processes. Such products may or may not be identified on store shelves by 'green labelling'. For example, a shirt for sale at Fair Trade in Wellington, New Zealand, made by a tailor in Kathmandu, Nepal, may be purchased over the Internet from almost anywhere in the world.

Beck also suggests that we live in an age of manufactured risk; risk is no longer an act of God, but of science-based intervention in the natural world (solving social and economic problems). As such, science and politics are our 'second modernity' (Beck, 1982, p. 4). But what of morality? Beck further suggests that new forms of reflexivity are developing in which people are losing faith in all forms of authority (including that of scientific enterprise) and are creating their own understandings. Increasingly, at least in the developed world, the 'new individualism' is contested by the notion of a global citizenship. This includes the proliferation of green technologies on a local scale. However, this is counterbalanced by the need to maintain communities of sustainable integration. A warning is given by Brown in his article 'It's income tax time for Americans, and it's time for the entire world to lower income taxes and raise environmental taxes'. In this article Brown claims that socialism collapsed because it did not allow the market to tell economic truth, and predicts that capitalism may collapse because it does not allow the market to tell the ecological truth (Brown, as cited in Peet, n.d., p. 16).

Education

'Education for sustainability' is a term developed from the natural and social sciences. It denotes the process of change that leads people and communities to live in sustainable ways. In its role as critic, conscience and arbiter of social good, higher education has a crucial role in analysing, synthesising, authenticating and disseminating the message of sustainability. The main goals for sustainability in education include:

- bringing about changes in behaviour and lifestyles
- disseminating knowledge and developing skills
- incorporating sustainability in pedagogy
- incorporating sustainability in management practices and processes
- preventing the exhaustion of non-renewable resources.
- equity and fairness
- education for well-being and peace education
- rights of indigenous cultures
- integration.

Stone and Baldoni (2006, p. 1) claim that the sets of expectations for sustainability in education are multiple and include: revising the underlying values of society; revising the nature of programmes themselves incorporating sustainability templates; widening the pool of knowledge about sustainability; targeting specific audiences for sustainability education; mandating institutional requirements for sustainability; and broadening and deepening educational research and development. Sustainability in pedagogical practices includes the analysis of the interactivity between social, economic and environmental concepts and knowledge sharing and environmental awareness. Relevant curriculum areas are: environmental law; diversity in cultural and ethnic perspectives; ecological life-support systems; methodologies in research and investigation; the interdependence of systems, organisations and relationships; the maintenance of biodiversity; environmental literacy; climate change; and the cultural and population demographics within the global geographica. Methods of curriculum engagement in the sustainability movement include:

- partnerships, cooperation, collaboration
- integrative and cross-sector learning
- futures thinking, situation improvement, making judgements about quality gains
- critical enquiry, reflective thinking, contrasting, generating solutions
- cooperative learning, enquiry-based learning, experiential learning.

Stone and Baldoni (2006) also acknowledge that sustainability is most clearly recognised in engineering technology programmes, and concerns in tertiary education vary from understanding natural and physical processes to knowledge dissemination and pedagogy in multidisciplinary and resource management curricula.

Calder and Clugston (2003, p. 4) advocate the encouragement of all tertiary educational organisations to engage in education, research, policy formation and information exchange on sustainability issues and practices. Furthermore, they propose the establishment of programmes to produce expertise in environmental management, sustainable economic development, and population demographics, to ensure that all university graduates are environmentally literate and have the knowledge to become ecologically responsible citizens. Certainly this is consistent with the political rhetoric coming from the 2009 US Democrat administration of Barack Obama, with its pre-election promise of a \$150 billion 'Apollo' project to bring green jobs and energy security to the USA through an alternative energy economy (Lean & Doyle, 2008). These 'green jobs' will require training for both industry and the education sector.

Calder and Clugston (2003) further emphasise the importance of new pedagogical approaches that include systems thinking, learner exposure to issues of equity and justice, and interdisciplinary learning. They advocate the establishment of curriculum courses involving sustainability topics such as: globalisation and sustainable development; urban ecology and social justice; women's development; campus ecosystems (sources of food, water, energy, waste end-point); renewable energy; sustainable building design; ecological economics; populations and development; environmental justice; reducing the ecological 'footprint'; sustainable building construction and renovation; environmentally responsible purchasing of food; uses of consumables (paper other products); student orientation; lecturing according to sustainability issues; and fostering local, regional and global partnerships. They further call for TEOs to include sustainability in organisational charters and mission

statements, incorporate structural procedures into mission plans, and register and communicate sustainability through environmental reporting mechanisms (Calder & Clugston, 2003, p. 5).

This orientation towards sustainability is consistent with the *Talloires Declaration 10 Point Action Plan*, an agreement signed in 1994 by an Association of University Leaders for a Sustainable Future that calls for 'urgent actions' to address problems of 'unsustainable production and consumption patterns that aggravate poverty in many regions of the world'.⁵ The goals of the Talloires plan are to educate, research, form policy, and exchange information in order to achieve 'stabilization of human population, adoption of environmentally sound industrial and agricultural technologies, reforestation, and ecological restoration' (Association of University Presidents for a Sustainable Future, 1994, p. 1).

Calder and Clugston's concepts and the Talloires Declaration all point to the critical role in higher education of authenticating, legitimating and disseminating the sustainability message as organisations that reflect the priorities of the societies in which they take part. Institutions adapt to the demands of government and disciplines are shaped by what academics, funders and stakeholders require. Sustainability involves shifting the scope of these requirements towards a set of achievable goals that are socially, economically and ecologically informed.

Goldman, in the education wing of The Tahoe Center for a Sustainable Future (California), has identified 17 main points for teaching sustainability (Goldman et al., 1999, p. 11):

- strong core academics
- understanding relationships between disciplines
- systems thinking
- lifetime learning
- hands-on experiential learning
- community-based learning
- effective use of technology
- partnerships
- family involvement

- personal responsibility
- human development and Earth's natural system
- increased awareness of local, environmental, cultural and economic issues
- stewardship of environment, personal connection to social and environmental aspects of their community
- increasing comprehension through work with positive adult role models
- develop critical thinking skills
- develop citizenship skills – diverse view points
- systems thinking: connections, concepts, relationships to whole, material and intellectual processes, interactive consequences.

Applying Turner, Ignace and Ignace's (2000) view of traditional ecological knowledge to the education system is a matter of correlating similarities within processes and resources. The succession and interrelatedness of all components of the environment corresponds to courses/degree structures/interdisciplinarity. The use of ecological indicators and adaptive strategies for monitoring, enhancing and sustainability corresponds to managerial processes. The effective systems of knowledge acquisition and transfer, and respectful and interactive attitudes and philosophies correspond to research practices, the close identification with ancestral lands and beliefs that recognise the power and spirituality of nature correspond to the ecology of the TEO base.⁶

As Dale and Newman (2005) have suggested, a common criticism of sustainability in higher education is that it is normative, ambiguous and ineffective. This may be due the fact that it is values-based as well as empirically motivated in bringing about sustainable practices. However, sustainability is rarely criticised for being unreflective; it implies a degree of analytic competency and proactive systemic thinking. Inherent in all sustainable motivations is a belief in intergenerationalism, solving problems for the current and future generations. Most programmes for education for sustainability will claim that pedagogical aims include acquiring a set of skills to reflect upon the complex nature of social, environmental, economic and systemic problems that involve adaptive systems thinking. Skill sets include: interdisciplinary interconnectivity, environmental literacy, epistemology process, facts-based analysis involving individual situations and group relations, and the ability to fit the local and specific into a global whole.

As Dale points out, sustainability is one of the few disciplines in which 'vagueness' has a purpose – the ability to conceptually adapt and modify to new situations, remaining flexible to change and accommodating to and resisting shifting value systems (Dale and Newman, 2005, p. 2). Waldrop (1992) maintains that complex systems have two defining properties – self-organisation, and spontaneity and adaptiveness to change. Bar-Yam (1992) theorises that human civilisation is a super-organism. While natural capitalists may be attuned to the physics of the economy (Hawken, 1993), suggests that sustainability practitioners as 'natural capitalists' explore the reconciliation of the value-chain of supply and demand, resource usages, efficiencies that preserve naturally occurring value and biotic diversity, under a rubric of interconnected ecological and social imperatives. As such, sustainability pedagogy may be informed by a process-orientated practice that represents a constantly changing set of objectives related to environmental usage rather than a finite goal (Dale & Newman, 2005, p. 3). While accommodating and promoting diversity, sustainability advocates also promote environmental unification.

As Wals and Jickling (2002) suggest, education for sustainability engages students in social-scientific pursuits. While the discipline may contain an inherent flaw in the concept of continuously keeping going (given the second law of thermodynamics as it applies to classical physics), the perpetuation of the human species within a sustainable biosphere is a fundamental human value as well as an evolutionary and physiological imperative.

Conclusion

The sustainability movement calls upon the shared connections across and between disciplines to provide different techniques for registering and ameliorating the different views between incompatible value systems that proliferate in the social, economic and ecological spheres, leading to new formulations of sustainable practices at their confluence (Dale & Newman, 2005, p. 2). The inherent pedagogical aims of students of sustainability – to explore diversity and understand differences; to acquire the tools of analytical reasoning about the environment, the economy and society to mediate between contesting value systems; and even to hold two or more contradictory positions at once – culminate in the knowledge of how to act as informed agents for change towards sustainable lifestyles. While it is questionable whether the mantra connotes unconditionally positive values (Dale & Newman, 2005, p. 2), positive values have a necessary place in maintaining well-being and advancing motivational conditions for a sustainable human environment. Others have claimed that environmental issues are not fundamentally about sustainability, but about cultural identities, social and ecological equity, and relationships between society and nature (Dale & Newman, 2005, p. 2). The constant variable common to both these approaches in the disciplinary development of sustainability in education is that, given that human society and the biosphere are dynamic, it describes a process in which nothing is predetermined. Self-environment actualisation may be a continual process of adaptation and change in response to the human and natural cycles and the environmental, social and economic pressures that determine it. An exploration of sustainability as it is related to indigenous principles, beliefs and culture, business tenets and philosophies and education demonstrates how interdisciplinary inter-relatedness may result in an ethos of human environmental enhancement.

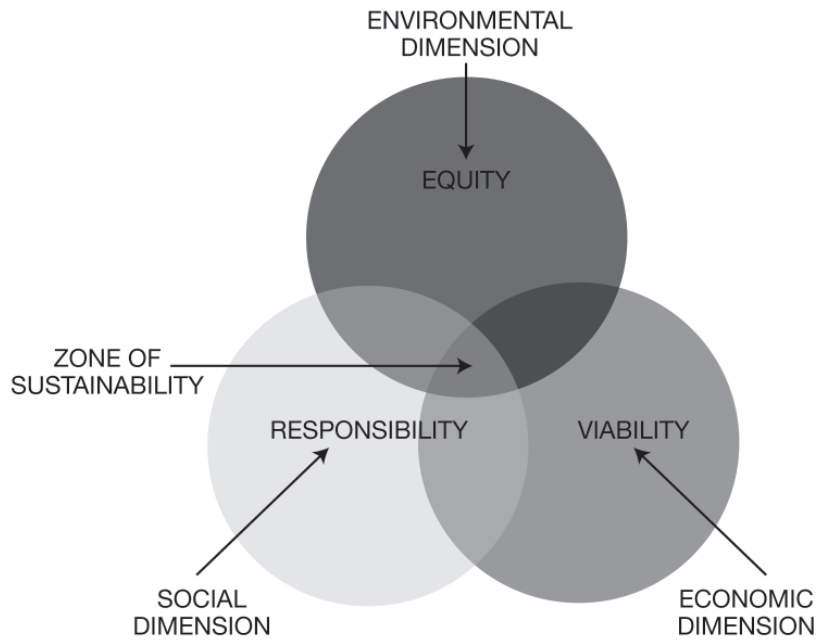


Fig. 1 Sustainability – the convergence of praxis

Notes

1. Goldman et al. (1999, p. 15) state:

Among the major factors contributing to the degradation of the environment are population pressures, particularly widespread poverty. (*Educating for a Sustainable Future*, UNESCO) From 2.5 billion in 1950, world population is projected to reach more than eight billion by 2025. The human population places the greatest stress on Earth's resources and natural processes. The U.S. Geological Survey (USGS) estimates that the use of air, water, and other natural resources has increased by a factor of 10 in the past 200 years. A cycle of consumption and overuse is perpetuated as areas are developed, resources exhausted, and populations relocate. Excessive fishing, harvesting and grazing result from increased demand for food, goods, and services, which increases the demand for natural resources and land use.

2. Wilson's comment is debatable, as in terms of biomass the human population is vastly exceeded by the insect population.
3. It has been claimed that the notion of a 'public' is, after all, an eighteenth-century European concept. See Immanuel Kant (1784), *What Is Enlightenment?*
4. Survey results on the benefits of sustainability for purchaser loyalty and influence revealed mid-percentile increases in product purchase, consumer loyalty and good will, and lower increases in price concern. (See 'The benefits of sustainability', 2008).
5. See the appendix.
6. Further applications for the Open Polytechnic of New Zealand (the author's organisational workplace) may involve incorporating a sustainability clause in all course materials. Here is one suggested format:

The Open Polytechnic is committed to sustainability under its Polygreen management programme. The Open Polytechnic recognises that a sustainable equilibrium between socialisation, the economy and the environment is important in tertiary education. Sustainability is endorsed in the Open Polytechnic's processes, practices and intellectual properties. Enrolling in our courses and programmes contributes to education for sustainability (EFS) under the Polygreen scheme.

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Appendix

The main principles of the Talloires Declaration 10 Point Action Plan (1994) are:

1. Increase Awareness of Environmentally Sustainable Development.
2. Create an Institutional Culture of Sustainability.
3. Educate for Environmentally Responsible Citizenship.
4. Foster Environmental Literacy for All.
5. Practice Institutional Ecology.
6. Involve All Stakeholders.
7. Collaborate for Interdisciplinary Approaches.
8. Enhance Capacity of Primary and Secondary Schools.
9. Broaden Service and Outreach Nationally and Internationally.
10. Maintain the Movement.

