Kopnina, H. (2016) ‘Closed-loop production models in Environmental Education: Teaching circular economy and the business of subversion'. *A Future Beyond Growth: Towards a Steady State Economy.* Ed. by H. Washington and Twomey, P. New York: Routledge. Pp. 70-83.

Sustainable business – what should it be? Circular economy and the ‘business of subversion’

By Helen Kopnina

Introduction

According to the critics of conventional sustainability models, particularly within the business context, it is questionable whether the objective of balancing the social, economic and environmental triad is feasible, and whether human equality and prosperity (as well as population growth) can be achieved with the present rate of natural degradation (Rees 2009). The current scale of human economic activity on Earth is already excessive; finding itself in a state of unsustainable ‘overshoot’ where consumption and dissipation of energy and material resources exceed the regenerative and assimilative capacity of supportive ecosystems (Rees 2012). Conceptualizing the current ‘politics of unsustainability’, reflected in mainstream sustainability debates, Blühdorn (2011) explores the paradox of wanting to ‘sustain the unsustainable, noting that the socio-cultural norms underpinning unsustainability support denial of the gravity of our planetary crises. This denial concerns anything from the imminence of mass extinctions to climate change. As Foster (2014) has phrased it: ‘There was a brief window of opportunity when the sustainability agenda might, at least in principle, have averted it’. That agenda, however, has failed. Not *might fail*, nor even *is likely to fail* – but *has already* failed. Yet, instead of acknowledging this failure and moving on from the realization of the catastrophe to the required radical measures, the optimists of sustainable development and ecological modernization continue to celebrate the purported ‘balance' between people, profit and planet.

Critics have found that the stated goal of maintaining economic growth, creating more wealth while simultaneously keeping the health of the ecosystems intact – is oxymoronic (Rees 2010; Foster 2014; Washington 2015). Critiques have noted that programs to promote ‘economic development’ may have caused more harm than good in promoting a system of production and consumption that is essentially unsustainable (e.g. Washington 2015).

The most prominent (as well as constructive critique) was voiced by the proponents of alternative economic systems such as the steady-state economy (e.g. Daly 1991), closed-loop production such as ‘Cradle to Cradle' or ‘C2C' (e.g. McDonough and Braungart 2002), and circular economy (e.g. Webster 2007; Huckle 2012). The steady state economy is based on a steady sustainable population and a minimized throughput of resources. The former is not inherent in the term ‘closed loop’ process, while C2C aims to reduce throughput.

This reduction of throughput requires deconstruction of the mainstream sustainability approaches. Within these ‘mainstream’ approaches, the ‘eco-efficiency’ (doing more with less) was criticized for leaving the existing destructive system of industrial production intact. McDonough and Braungart (2002) have argued that industrialization has unintentionally created a system that resulted in an alarming amount of toxic materials discharged into the air, water, and soil, as well as an ever-increasing amount of waste disposed of in landfills or incinerators.

The closed-loop systems and circular frameworks are often discussed as hopeful alternatives to the ‘mainstream’ ‘eco-efficiency’ which essentially makes a bad thing (design, or form of energy) last longer... Cradle to Cradle and circular economy frameworks call not for ‘small steps’ and reducing the damage, but for a radical re-evaluation of the methods of production that is fully good, not a bit less bad. Basically, the circular economy and C2C emphasizes that the biggest danger of resilience, adaptation, or mediation thinking that is so prominent in sustainability discourse, makes the bad

system literally more sustainable, as resilience through eco-efficiency or recycling allows for relative durability of bad design.

Indeed, as Crist has reflected, perceiving nature as a human resource base that can be easily modified by being more efficient allows one to speak of the malleability of resources without perceiving the great damage done to the long-term survival or health of the natural systems:

> More serious than modern society's potential ability to technologically fix or muddle through problems of its own making is people's apparent willingness to live in an ecologically devastated world and to tolerate dead zones, endocrine disruptors, domestic animal torture (aka CAFOs), and unnatural weather as unavoidable concomitants of modern living ...What is deeply repugnant about such a civilization is not its potential for self-annihilation, but its totalitarian conversion of the natural world into a domain of resources to serve a human supremacist way of life, and the consequent destruction of all the intrinsic wealth of its natural places, beings, and elements (2012: 148–149)

In fact, empirical evidence of mass extinctions in the last few decades, as well as population growth, illustrates that the human population is much more resilient to pollution, climate change, desertification, and deforestation than flora and fauna (Shoreman-Ouimet and Kopnina 2016).

The steady state economy perspective also calls for the recognition of twin forces of population and consumption growth, and the need to address difficult questions in relation to the moral responsibility of humans to the natural world (Daly 1991). Translated into educational practice, this means putting an emphasis on ecologically-benign models of production and consumption (e.g. McDonough and Braungart 2002; Webster 2007; Huckle 2012; Kopnina 2013c). As an educational charity, the Ellen MacArthur Foundation (http://www.ellenmacarthurfoundation.org/case_studies/coca-cola-enterprises) promotes debate and discussion around the possibilities inherent in just one of these models: a transition from today's predominately linear 'throughput' economy to one which, reflecting insights from living systems, is a circular or 'roundput' economy (Webster 2012). However, while the Ellen MacArthur Foundation is the champion of the circular economy, it sees this as a 'new engine of growth'. Many ad hoc circular economy educational activities sprang up in different universities, including a few in the Netherlands.

While the closed loop and circular economy models have a significant role to play in sustainable resource management, they are not without limitations. As Washington (2015) notes, sustainability should not be allowed to be subverted and high-jacked to justify further 'business-as-usual' growth. Even hopeful alternative frameworks can be subject to subversion. For example, the 'pioneers' of the circular economy, or 'Cradle to Cradle' have indeed sometimes profited from setting up certification systems, limiting the global applicability of their concepts, or sometimes cooperate closely with companies that do not strictly adhere to these frameworks (Brennan et al 2015).

This chapter explores how students can be taught to distinguish between more helpful sustainability frameworks (in terms of their ability to avoid environmental harm), and how the pitfalls of subversion of these helpful frameworks can be avoided. The following sections will explore the closed loop sustainability frameworks, discuss the areas in which subversion is possible, and discuss its implications for teaching these frameworks using the case study of Bachelor's students of minor Circular Economy in the Cloud, an experimental online course piloted by vocational schools in Rotterdam, Utrecht and The Hague universities in The Netherlands.

Closed loop sustainability frameworks

The circular economy model argues that the functioning of ecosystems is as an exemplar for industrial processes and systems, emphasizing a shift towards ecologically-sound products and renewable

energy, as well as highlighting the role of diversity as a characteristic of resilient and productive systems (Ellen MacArthur Foundation; Brennan et al 2015). Diesendorf (2014) has demonstrated that appropriate technologies such as renewable energy, energy conservation, and sustainable building are both economically and socially feasible.

The ideas of a circular economy were adopted by the American architect, William McDonough, and the German chemist, Michael Braungart. The idea behind their critique of the current system is that production remains linear, 'cradle to grave' process that, despite efforts at eco-efficiency, still results in waste. Cradle to Cradle framework criticizes 'eco-efficiency' and recycling, stating that they enable the bad system to last longer. In this view, a bad thing (such as fossil fuel motors in cars) should not be 'efficient', rather they should not be there in the first place. Even the conventional eco-efficiency approach and well-intentioned practice of recycling lead to mostly 'down-cycling', where materials are reused to make products of lower quality, which require a new application of energy to produce a new product.

The application of the idea of a production system that does not produce unproductive or unusable waste at an economic level was propelled forward by reports by the Ellen MacArthur Foundation and other initiatives stimulated by both government and business stakeholders (Brennan et al 2015).

Thus, proponents of both circular economy and the closely related 'C2C' share their support for the forms of production that support an endless cycle of materials that mimics nature's 'no waste' nutrient cycles. These frameworks basically adhere to the 'waste = food' principle. This principle is well illustrated by the metaphor of the cherry tree, which produces 'waste' (berries, leaves, etc.) that actually serves as food for other species and for the formation of the soil.

C2C proposes that only biodegradable materials (biological nutrients) and non-compostable materials (technical nutrients) should be used, so that a product can be disassembled and the two kinds of materials can be either left to disintegrate and be used for agricultural fertilization (although other uses are also possible), or reused without the loss of quality and energy for a different product. Inspired by such frameworks, some companies have noted that the closed loop model is in line with traditional 'business sense' through its potentially immense savings.

The risks of subversion

However, there are trade-offs that need to be considered when it comes to implementing circularity ideas, in terms of design and business implications. Closed-loop frameworks need to be understood in terms of their strengths and their weaknesses. Brennan et al (2015) reflect: 'Keeping a product in use for longer implies that direct sales of new products decrease, impacting on-going profits that could otherwise be made. This is a challenge to mainstream business operations that rely on repeat purchases by challenging the popular 'planned obsolescence' approach.

Critical observers have noted that companies that get certified as C2C (http://www.c2ccertified.org/get-certified/product-certification) or placed on the list of 'good practice' case study examples on the circular economy (see the website of Ellen MacArthur Foundation http://www.ellenmacarthurfoundation.org/case_studies), though they are not necessarily following the ideal principles as originally explained. Some of the companies listed, for example, Coca-Cola, have indeed taken some steps toward reducing material use in each stage of the packaging chain (materials, design, disposal, recovery, and recycling). It has a modest aim of 'reducing 25% of the material used by 2020' and to 'to improve the overall recyclability of their packs'. Clearly, however, recycling rather than upcycling is still used as the key concept, and the goal of reduction of 25% of the material leaves questions about the rest of 75 %. It also makes one wonder about why such reductions cannot be accomplished *before* 2020. Their current re-use is about 7 % (http://www.ellenmacarthurfoundation.org/case_studies/coca-cola-enterprises).

Critics have noted that some of these companies improve one small part of their operation, without the needed overhaul of the *entire* supply chain, mode of operation and radical change in product

materials. Nevertheless, despite such problems they were able to obtain an expensive certificate or placement on the C2C and circular economy websites. Many critics have pointed out that endless economic growth is simply incompatible with sustainability and social equality, and have pointed out that aspirations of most commercial companies (such as those listed on Ellen MacArthur website) still tend to be supportive of the endless growth model. Instead, the steady state economy approach has been proposed.

The key parts of the steady-state economy are fixed population (at an ecologically sustainable level) and a constant sustainable throughput of resources (Daly 1991, 1996). The steady state economy espouses the vision that the economy is an open subsystem of a finite and non-growing ecosystem, the environment. The economy lives by importing low-entropy matter-energy (raw materials) and exporting high entropy matter-energy (waste). It is suggested that any subsystem of a finite non-growing system must itself at some point also become non-growing. Additionally, critical authors have emphasized that environmental, social and economic problems are caused by the growth economy and that 'growthism' itself as an unsustainable ideology (Washington 2015). 'Growthism', as well as innovation without a clear aim, is likely to result in the same effects discussed by McDonough and Braungart in relation to eco-efficiency. By softening the blow of *un*sustainability by resorting to 'eco-friendly' technologies and scientific innovations, we might be discovering that unsustainability can, in fact, be sustained for very considerable—even though not unlimited—periods of time. In Blühdorn's (211:44) words: '

> *It can be maintained if (and as long as) ways can be found to reduce their environmental side effects, that is, the physical referent of social problem perceptions (e.g., by means of techno-managerial fixes or policies of displacement), if (and as long as) there are strategies for managing their social impact, be it reduced or not (e.g., by means of displacement, externalization, or enhanced security systems), and if (and as long as) social norms and expectations can be adapted in such a way that the social and ecological side effects are no longer perceived as unacceptable*.

Thus, optimistic prescriptions and the apparently 'simple and easy' approach need to be treated with caution. Also, without strict measures counteracting population growth, any efforts at innovation in production, including that of the circular economy, are likely to fail (Rees 2010). If social and particularly economic equality is taken as *the* central departure point for sustainability and ethics (as it is often formulated in the mainstream sustainability literature), the underlying limits to growth are likely to be forgotten. In their focus on the dynamics of social exploitation and inequality, those who are drawn to the social equality aspects of the mainstream sustainability approach tend to place the exclusive culpability for unsustainability (and unethical consumption) on the neoliberal, industrial or political elites who are reaping the multi-generational benefits of unjust and unsustainable lifestyles. Yet, proponents of social equality, while correct in assuming that unfair distribution of environmental risks and benefits is permitted by fundamentally unsustainable socio-economic relations, tend to ignore another significant dimension of unsustainability – population growth. Many authors think about population not as a global issue, but as an issue that concerns only the increasing numbers of a highly privileged and highly exploitative minority, by which they normally mean the over-consumptive North. One of the persistent claims is that resource use by marginal human communities, those of the 'victimized South' is either 'relatively benign' or 'environmentally innocuous' (Robbins 2012). This position is well illustrated by Fletcher et al (2014) which argue that the focus on overpopulation in the developing world focuses attention away from Western consumption; obscures inequality in Western consumption, and ignores the fact that the capitalist system encourages unsustainable overconsumption *everywhere*.

Simultaneously with this 'blaming the rich (Western) consumers, the questions associated with human population growth are often ignored in politically correct academic circles – perhaps due to the geopolitics and political correctness (Smail 2003; Campbell 2012). Yet, the fact remains that the basic causes of unsustainability lie in the *combined* action of (a) technological advance; (b) population

increase; and (c) conventional (but wrong) ideas about the nature of man and his relation to the environment (Bateson 1972). If we assume that social justice concerns are valid (and we want *everybody* in this world to live 'decent' lives), expansion of wealth will necessarily cause greater pressure on the planet (Wijkman and Rockström 2012**).** Having many children in the poorest countries also further impoverishes people (The Economist 2009, 2014). Furthermore, although the rich countries have been responsible for causing issues such as climate change, the poor countries are rapidly 'catching up' as witnessed by 'developing' countries. As Crist and Cafaro (2012:6) summarize it:

> *To scrutinize the global North and see only the variable of consumption is to remain blind to that mass that qualifies it. A major factor underlying destructive consumerism is population size: the sheer numbers of consumers around the globe. To propagate the myth that population growth is not itself a problem and to lament, instead, the harmful effects of unsustainable production and consumption bypasses one leading reason that production and consumption are unsustainable*

Another significant issue is the fact that a growing population serves capitalist, industrial and expansionist interests as population creates a 'demographic dividend' which is good for the growth economy (e.g. Forbes 2009). It is not just defenders of human rights and proponents of 'every (human) life is sacred' mantra, but also corporate and political elites might see population growth as an opportunity for bigger markets (Blowfield 2013). Thus tackling population growth would go against the grain of capitalist industrialist expansionism and be opposed by the elites on 'humanitarian' grounds (Washington 2015). It is a worrisome trend that academics seemed to have bought into this deception. When human populations increase in number, they consume more, when human populations increase their socioeconomic level, they consume more, especially more meat (http://www.worldwatch.org/global-meat-production-and-consumption-continue-rise). Thus, unless we assume that poor people will always stay poor and unless it is assumed that somehow the consumer ideology is going to spontaneously give way to much more ecologically benign practice, the insistence that population is not a problem seems at best naive. Denying a problem of the growing population whose appetites, material aspirations, and life expectancy have greatly increased, seems detrimental to the aims of achieving sustainable development in the long term.

Thus, considering the questions of social justice, the need for critically addressing the production and consumption systems everywhere appears even more urgent. Without adaptation of production and consumption, which in effect implies radical re-orientation of existing models, population growth threatens – and already does – exacerbate sustainability challenges globally, and indeed leave large parts of human population dispossessed – not just of natural resources for today, but of future prospects.

As the case study below will illustrate, subversion of C2C and circular economy models is a real danger that needs to be considered if C2C, and the circular economy is to be a useful part of a steady state economy and a tool to reduce the environmental crisis.

The case study

This case study is based on the minor 'Circular Economy in the Cloud', an experimental online course piloted by Universities of Applied Sciences (vocational schools) in Rotterdam, Utrecht and The Hague business departments. The course was initiated in September 2014 by the Rotterdam Business School, and the author was a tutor/assessor.

The main objective of this minor course, given between September 2014 and February 2015 was to teach students what the circular economy is, and how 'Small and Medium-size Enterprises' (SME's) could make the transition from a linear business model to a circular economy business model. 68 students were initially enrolled in the minor course with 39 completing it. The course had a strong practical component, which meant that the sponsor company was supposed to implement all or a part

of the changes recommended by the students. International knowledge and experience-sharing through the cloud were seen as being key to the quality of the student deliverables. The students were supposed to improve the ability to combine knowledge, skills, and attitude to show expected behavior when performing a professional task in a European/ international business context. Prior to the start of the course, SME's were contacted by lecturers to ask for their participation. A total of 17 SME's were selected to participate and students chose which company to work with. Students carried out a follow-up with the selected company. SME's were willing to participate because they expected to benefit from the practical solutions the teams would offer.

It was assumed that the companies would benefit from relevant information in order to keep up-to-date with the most efficient and effective techniques, like in procurement and inbound logistics. They would be able to select and develop the technologies that would give them a competitive advantage, and decide if it is relevant to make some changes in their action plan. The project groups were supposed to make a valuable input into the overall strategic planning for their sponsor company, producing a proposal that would serve as a guideline for the company to take important decisions related to the supply value chain that would allow the company to transit to the circular model. Overall, the aim of the course was to critically consider the aspects of 'added value' to product or service.

Findings: company M

The two teams that the author supervised did their project with a company that made bridges (company M). Company M was founded in 2012. The student group worked on 'bridge division'. The aim was to advise the company to transit from linear to circular model of production, as well as to help the company gain access to other European countries. The students provided the client with a value chain analysis of two of its biggest competitors. Another purpose of the report was to make a comparison between wooden bridges and composite bridges and provide the client with an analysis with a focus on sustainability.

Students researched the materials used for making bridges and their alternatives, primarily using Gkaidatzis (2014). In their report, the students specified that the bridges are manufactured from steel, plastic, resins, and fiber. Most natural fibers have different specifications and functions that highly depend on the plant environment. According to student research, the baste family (Hemp, Flax, and Jute) may have specific strength and material properties that compete with glass fiber. This family of natural fibers has a higher 'elongation to break' ratio than glass or carbon fibers. This can improve the performance of the composite is used for reinforcement (Gkaidatzis 2014). Based on this information, the students proposed the use of these fibers to their sponsor company.

The group pitched a proposal to their sponsors after four weeks. After evaluating the working processes of company M's competitors, the students reported that the competitors are more mature and have been in business longer. At the end of the project, the company responded that the change of materials for production was not feasible *due to financial constraints*. The students reported that they had begun to doubt the feasibility of the transition, as well as the company's willingness to undertake the necessary steps. In their final report, the obstacles to successful implementation as reported by students included the lack of top management commitment to the project and unwillingness of the company to change its business model.

Reflection

Students in some cases were refused information about materials used by the company, or about the whole supply chain or parts of it. Hence it seems the student study was largely unsuccessful. There appears to be a degree of mismatch between the expectations of the company and those of the students. There also seemed to be a mismatch between theory and practice in the sample of companies that the student teams approached. The original aim was for student teams to help the company to make a business plan transition from a linear to circular economy model. However, the subversion of the original aim of the project may be due to a number of factors.

First, the mismatches had to do with the recruitment method, as the companies were told that they would be working with business students that are interested in sustainability. The companies were not explicitly informed about the circular economy models (and did not seem to have a good understanding of what this was). Rather, most companies in the sample asked the students to help them with 'business as usual' projects – marketing, branding, finance, assuming that the company was already 'green enough' and that business students could help them to spread their 'green' credentials.

Second, there were a number of practical constraints that companies experienced when examining financial viability and the radical overhaul of established practices within the *entire supply chain* of the company's product or service. Many companies realized half-way through the project that they either could not (or did not want to) undergo the transition from linear models - because it was seen as impractical, expensive, or altogether impossible (given the nature of their product). Another mismatch observed was between what students learn in macro-economic theory and the application through micro-economic scenarios in small companies. As a result, the students were disappointed regarding the outcome.

Despite these difficulties, it is important however not to 'throw the baby out with the bathwater' here. Cradle to Cradle and Circular economy frameworks, however, do deserve support, as ideally, they go way beyond mainstream sustainability strategies – but they do have a long way to go in practice. It is thus crucial to make a distinction between ideal practice, possible practice and subverted practice. In the context of this case study, it did not appear that students made a meaningful contribution to the companies. However, they did gain a critical learning experience. Progress towards workable C2C transitions, however, may not happen unless a number of adjustments are made.

The big challenge is how to find something applicable and practical at BA-level, with enough 'good' companies willing to participate, and how to match the macro-theory and ideas to the actual practice. Following this, more successful integration of theory and practice and alignment of expectations should include:

1. A concise summary of the circular economy and the expectations of the student study should be given to the participating companies *before* they agree to participate

2. Another way of approaching the challenge of transition to a circular economy is to embrace economic and social pragmatism. In the context of sustainability, this could mean doubting not only the linear and existing models of production, but also scrutinizing the alternatives and seeing what works best in each case. In this case, the 'best' would imply being workable, feasible, with least impact - even if not a totally closed-loop model. For example, while it might be all but impossible to build a 100% sustainable bridge using organic fibers, a compromise between the use of acceptable, desirable, and perhaps less-desirable materials might need to be made.

Discussion

Despite the difficulties reported, it should be emphasized that the models that support Cradle to *Grave* production are not an alternative, however great the obstacles to the circular economy or C2C realization. Good examples of production that eliminates unproductive waste altogether are not hard to find, as they can be historically found everywhere in the form of pre-industrial production systems. Until very recently, shoppers have brought their own glass bottles to be refilled at the shops (or the proverbial milkman has distributed those same washed bottles by horse and cart). In India, the author has witnessed production of clay cups created from the mud at hand, filled with tea, and smashed back into the ground to form a new material for a new cup instantaneously. The movement of the wrist used for spinning the clay pot platform was no more labor-intensive or strenuous than that of a barman serving drinks.

This does not mean that producers and consumers should revert back to a pre-industrial lifestyle, nor that producer should sell 'retrogressive' design products. Intelligent marketing has been known for generations to sell old ideas as new (Blowfield 2013). Besides, many truly innovative technologies –

particularly in the area of solar and wind energy have indeed offered attractive and forward designs. For example, solar power has spread to many applications in the past decades, from space to military technology, to multiple civilian appliances, transport, and consumer electronics. Solar power used for military drones and space technology meant economic and practical benefits as electrically powered drones do not transport fuel or carry recharging equipment. To take an example of drones, these small airplanes can survey pipelines and power cables, perform aerial filming, including detection of poachers in protected conservation areas, monitor fires, and assist in search-and-rescue operations. Other applications included a Sunkseeker solar airplane, designed by the Solar Flight. At the moment of writing, a solar airplane Solar Impulse is making its way around the world (http://www.solarimpulse.com/).

More generally, one does not even have to admit that humanity made a mistake 200 years ago during the intense love affair with the 'progress' engendered by the industrial revolution, but just move on in the direction of new ecologically benign revolution. After all, many corporate leaders are known for their optimism, and ability to turn consumer's non-existent needs into persistent desires. If one such desire is for a sustainable future, perhaps the power of corporate leaders to transform the world could indeed we used for more long-term progress. What are 200 years in the course of the human history of production? It is time to go back to the 'tried and true' circular systems our ancestors understood.

Conclusion

Based on this reflection, we can recommend that in the teaching of the circular economy one should be aware of the pitfalls and risks such as the case of subversion of good intentions (and greenwashing).To be meaningful, 'sustainable business' must be based on an understanding of the environmental crisis we face, and the need to change the consumer throwaway culture, and vastly reduce the throughput of materials. The circular approach is potentially highly useful within a steady state economy – provided it remains true to the original idea and is not subverted to the cause of continuing an unsustainable business-as-usual model.

References

Bateson, G. (1972) 'The Roots of Ecological Crises'. In Bateson, G. *From Steps to an Ecology of the Mind*, Chicago: University of Chicago Press. Pp. 494-499.

Blowfield, M. (2013) *Business and Sustainability*. Oxford: Oxford University Press.

Blühdorn, I. (2011) 'The Politics of Unsustainability: COP15, Post-Ecologism, and the Ecological Paradox'**.** *Organization Environment* 24(1) 34–53.

Campbell, M. (2012) 'Why the Silence on population?' In P. Cafaro and E. Crist (Eds). *Life on the Brink: Environmentalists Confront Overpopulation*. Atlanta: University of Georgia Press. (p. 41-56).

Crist, E. 2012. Abundant Earth and Population. In P. Cafaro and E. Crist (eds), *Life on the Brink: Environmentalists Confront Overpopulation*, Atlanta, GA: University of Georgia Press, p. 141–153.

Crist, E. and Cafaro, P. eds (2012). 'Human Population Growth as If the Rest of Life Mattered'. In P. Cafaro and E. Crist (Eds). *Life on the Brink: Environmentalists Confront Overpopulation*. Georgia, US; University of Georgia Press. (p. 3-15).

Daly, H. (1991) *Steady-State Economics*. Washington: Island Press,

Diesendorf, M. (2014) *Sustainable Energy Solutions for Climate Change*, London: Earthscan.

The Economist. (2009) 'The baby bonanza: Is Africa an exception to the rule that countries reap a "demographic dividend" as they grow richer?', See http://www.economist.com/node/14302837

The Economist. (2014) 'Fertility treatment: Birth rates are not falling in Africa as fast as they did in Asia. More contraception would help'. See: http://www.economist.com/news/leaders/21598648-birth-rates-are-not-falling-africa-fast-they-did-asia-more-contraception-would

Fletcher, R., Breitlin, J. and Puleo, V. (2014) 'Barbarian Hordes: The Overpopulation Scapegoat in International Development Discourse'. *Third World Quarterly,* 35(7):1195– 1215.

Forbes. (2009) 'You Worry. You Shouldn't. Part 1': Overpopulation and Resource Exhaustion. See http://www.forbes.com/sites/artcarden/2012/06/15/you-worry-you-shouldnt-part-1-overpopulation-and-resource-exhaustion/

Foster, J. (2014) 'After Sustainability: Life Beyond the End of Pretending?', Blog post. See http://www.routledge.com/sustainability/articles/after_sustainability_life_beyond_the_end_of_pretending

Gkaidatzis, R. (2014) *Bio-Based FRP Structures.* Master Graduation Thesis, Technical University, Delft.

Huckle, J. (2012) Even More Sense and Sustainability: a review essay. Sense and Sustainability: Educating for a circular economy. *Environmental Education Research*, 18(6):845-858. http://john.huckle.org.uk/download/2954/EER2012MSandS.pdf

Kopnina, H. (2012) 'Education for Sustainable Development (ESD): The turn away from 'environment' in environmental education?', *Environmental Education Research,* 18 (5): 699-717.

Kopnina, H. (2013) 'An Exploratory Case Study of Dutch Children's Attitudes towards Consumption: Implications for Environmental Education'. *Journal of Environmental Education,* 44(2): 128-144.

McDonough, W. & Braungart, M. (2002) *Cradle to Cradle: Remaking the way we make things.* New York, NY: North Point Press.

Rees, W. (2009) 'The ecological crisis and self-delusion: implications for the building sector'. *Building Research and Information,* 37(3):300–311.

Rees, W. (2010) 'What's blocking sustainability? Human nature, cognition, and denial'. *Sustainability: Science, Practice, & Policy*, 6(2):13-25.

Rees, W. (2012) 'On the Use and Misuse of the Concept of Sustainability'. See: http://williamrees.org/misuse-of-the-concept/

Robbins, P. (2012) *Political ecology: a critical introduction*. 2nd ed, *Critical introductions to geography*. Malden, MA: J. Wiley & Sons.

Shoreman-Ouimet, E. and Kopnina, H. (2016) *Conservation and Culture: Beyond Anthropocentrism*. Routledge Earthscan, New York.

Smail, K. (2003) 'Remembering Malthus III: Implementing a Global Population Reduction'. *American Journal of Physical Anthropology*, 123(2):295-300.

Brennan, G., Tennant, M. Blomsma, F. (2015) 'Business and production solutions: Closing the Loop'. In *Sustainability: Key issues*. H. Kopnina and E. Shoreman-Ouimet, eds. New York: Routledge.

Washington, H. (2015) *Demystifying Sustainability: Towards Real Solutions*. London: Routledge.

Webster, K. (2007) 'Hidden Sources: Understanding Natural Systems is the Key to an Evolving and Aspirational ESD'. *Journal of Education for Sustainable Development*, 1 (1): 37 – 43.

Webster, K. (2012). 'Circular Economy'. http://www.ellenmacarthurfoundation.org/education/featured/circular-economy

Wijkman, A. and Rockström, J. (2012) *Bankrupting Nature: Denying Our Planetary Boundaries*. New York: Routledge.