THINKING ABOUT THE DAY AFTER TOMORROW – NEW PERSPECTIVES ON SUSTAINABLE BUILDING

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Abstract

Sustainable development, and with it sustainable construction, is a continuously evolving concept. This has resulted in several iterations of "green" building – from early notions of durability, flexibility, natural building and returning to self-sufficiency, to the currently dominant approach of eco-efficiency. This paper argues that while the past decade or more has seen many initiatives developed around sustainable building and construction, the contribution of these to the global sustainability project is neither sufficient in scope and tempo to achieve the transition to a more sustainable world before critical tipping points are reached, nor is it necessarily progress in the right direction. The problem with these first iterations is that they are, as William McDonough puts it, only trying to do a bad thing better. However, it is necessary to start thinking outside the boundaries currently placed on innovation by the need to stay within a range of practices acceptable to the dominant conventions of both industry and society. Quite simply, if we want meaningful change, we will need to start doing things differently from a different point of departure. The paper discusses one such possible point of departure, that of the ecological paradigm, based on a different worldview of humanity and nature working together as one interconnected intelligence to create a net positive impact, not just reducing a negative impact, and put forward some thoughts on how a shift to an ecological view of the world influences thinking around sustainable building and construction.

Keywords: sustainable, green building, ecological, paradigm.

The definition of insanity is doing the same thing over and over and expecting different results.

Albert Einstein

Introduction

The idea of building in harmony with nature has been around since ancient Greece, was revived by Vitruvius, and again by the 19th century Romantics like Ruskin and Morris. Driving this idea was both pragmatism and a nostalgic spiritual and aesthetic quest for 'reconnecting' with nature. The Cold War, the anti-establishment youth movement of the 1960s and '70s, the 1970s energy crisis, and rising environmental awareness, resulted in concepts such as 'natural building', 'green building', and 'ecological building'. Publications in the 1970s like "Shelter" and Brenda and Robert Vale's "The Autonomous House", responded by adding another dimension – that of self-sufficiency in a world perceived as increasingly dangerous and hostile to both the individual and the human species as a whole. This dimension prompted a return to the use of natural building materials, appropriate (often interpreted as traditional) technology, improved indoor air quality, the integration of building with site conditions (for example passive solar design), and efficient use of resources. These specifications would become the foundation stones for the green building debate during the next two decades, and directed the development of systems such as LEED and BREEAM.

Today, sustainable building and construction is seen as a vital element of the much larger concept of sustainable development that aims not just at environmental health and protection, but also at improving human well-being and meeting human needs. This concept itself keeps on evolving, resulting in many branches and iterations of sustainability, and thus of interpretations of what constitutes sustainable building and construction. Now, a decade after the first conference was held in Tampa, Florida to develop a common understanding and

definition of sustainable construction, the time is ripe to review the progress made since that first conference and ask whether we are still on the right road.

This paper argues that while there has been some progress, this progress is neither sufficient in scope and tempo to achieve the transition to a more sustainable world before critical tipping points are reached, nor is it necessarily progress in the right direction. It is therefore necessary to start thinking outside the boundaries currently placed on innovation by the need to stay within a range of practices acceptable to the dominant conventions of both industry and society. Quite simply, if we want meaningful change, we will need to start doing things differently.

The paper briefly looks at the progress made in terms of the international sustainability project, concluding that the many initiatives on sustainable development (and by extension, construction) have failed to make significant change to the development trajectory of the 21st century, and that one reason for this lies in the versions of sustainability that are promoted. To explain this statement, the second section of the paper provides an overview of the evolution of sustainable development as a meta-concept up to the point where a fundamental ideological split occurred within the discourse, with one branch leading back towards a slightly improved business as usual approach and the other towards a radical change in worldview. The third section then explores this change in worldview and its implications for both sustainability *ethos* and *praxis*. The fourth section then looks at how this shift in worldview influences thinking around sustainable building and construction.

Sustainability – a progress report

It is roughly forty years since Rachel Carson's "Silent Spring" (1962) and Kenneth Boulding's "Spaceship Earth" (1966); thirty years since the Club of Rome's "Limits to Growth" (Meadows, *et al*, 1972); twenty years since the Brundtland Commission published "Our Common Future"

(WCED, 1987); and almost fifteen years since Agenda 21 was presented at the Earth Summit in Rio (UNCED, 1992). It is one hundred and ten years since Svante Arrhenius (1896) calculated that increasing carbon dioxide emissions from human activities will lead to global warming, sixty-eight years since Guy Callendar (1938) warned that global warming is already underway, and almost twenty years since the establishment of the Inter-governmental Panel on Climate Change (IPCC).

In this time innumerable conferences and summits produced declarations, agendas, and strategies. Special task teams and advisory panels developed a surfeit of international, national and local policy instruments. Scientists published increasingly detailed research (and increasingly ominous warnings) about the state of the planet and its possible impact on human well-being. And a vast industry built on sustainability education, awareness-raising, measurement, assessment, monitoring, and reporting (much of it in the building and construction sector) was spawned.

Despite all these efforts, when the Millennium Ecosystem Assessment released the results of a four year global study into the state of global ecosystem services and the possible consequences of anticipated ecosystem change on human wellbeing, the board felt it necessary to present the following warning:

> *"…the results of human activity are putting such a strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted"*.
>
> (Millennium Ecosystem Assessment, 2005:2)

The assessment found that nearly two-thirds of the essential services provided by nature to humankind are in decline worldwide, and in many cases we are literally living on borrowed time. The scientists concluded that the protection of these assets can no longer be seen as

an optional extra, to be considered once more ‘pressing’ concerns such as human development and wealth creation have been dealt with.

In a similar vein, there is increasing evidence indicating that not only are the effects of global warming, especially in the polar regions, already visible far earlier than predicted, but that these effects themselves are accelerating climate change in a series of positive feedback loops. Whereas before climate change models predicted significant changes only occurring over hundreds of years, including these positive feedback loops in the models indicates that significant and possibly dangerous global climate change can be expected within current lifetimes. Yet, despite the clear and acknowledged links between anthropogenic contributions to greenhouse gasses and the current climate change event, atmospheric concentrations of carbon dioxide continue to grow, as does energy consumption, the destruction of carbon sinks and the production of waste. Clearly the warnings, the policy, the education and the green building assessments are not making enough of an impact to bring about meaningful change in the 21st century’s development trajectory – why?

The answer can perhaps be found in another of Einstein’s dictums – all these efforts at improving sustainability are failing because we are trying to find solutions within the same thinking, the same tools and the same worldview that caused the problems in the first place; and we are doing this to try and sustain a specific development trajectory that is in itself the real problem. To understand this statement, it is necessary to take a look at the evolution of sustainable development as a meta-concept.

Evolving sustainability

Sustainable development, and with it sustainable building and construction, is an evolving concept, and our understanding of the kind of responses and choices necessary for sustainable development are continuously evolving as our ability to understand the complex

dynamics advance, but also as more and more actors enter the debate, and the flaws and gaps in reasoning becomes apparent as theories are tested in real life. This has led to a number of frameworks, models and philosophical stances that confuse all but the most dedicated follower of Sustainable Development theory. Space does not permit a detailed expose of all the different frameworks and models involved and the following discussion is extremely superficial. It also does not describe a chronologically linear process of evolution, as different theories and variants developed concurrently, although at different speeds. Yet it is necessary to have some understanding of the origins and evolutionary pathways of the concept if we are to clear up some of the more fundamental misunderstandings that contributed to the less than stellar performance of the global sustainability project.

The cognitive framework of what was to become sustainable development was already laid down in the early 1970s by *The Cocoyoc Declaration* (UNEP, 1974). This seven page document contained the fundamental ideas around which sustainable development would be constructed in the years to come. These are:

- Meeting basic human needs within environmental limits,
- through limiting impact and consumption,
- in a co-operative world of networked settlements,
- in partnership with nature, and
- in solidarity with future generations.

Note that the challenge is not to be able to continue the development project kick-started by Harry S. Truman in 1949, but to ‘develop’ in an altogether new way, based on an entirely different relationship between people (of current and future generations) and between humans and their biophysical environment. This would imply far-reaching changes in the dominant development model – the ‘how’ of development - and the systems that guide development.

While there is general consensus that sustainable development is about restructuring the relationship between humans and their needs, and the broader environment (social and biophysical) within which these needs have to be met, there is considerable divergence in opinion regarding which approaches, priorities and drivers should take precedence (see Marshall and Toffel, 2005 for an extended discussion). At the root of most of these differences of opinion lies the debate about which is most important: the environment or human needs (including such needs as maximising shareholder value and achieving a high standard of living). This dualistic tension can be found in the debates around weak and strong sustainability (Turner and Pearce, 1993), Brown and Green Agendas (McGranahan and Satterthwaite, 2000; IIED, 2001), Shallow versus Deep Ecology (Naess, 1995), the Brundtland Commission's tensions of human needs versus environmental limits, and current versus future generations, and in the philosophical tensions between the current expansionist/mechanistic worldview and the new ecological worldview discussed below. The question that underlies these debates is: are we saving the planet or are we saving the world; and if we are saving the world, whose version of it are we saving? This presumed conflict between people and planet is supported by a powerfully entrenched worldview that sees the main responsibility of humans as creating order out of the chaos of nature, and is clearly visible in the different iterations of Sustainable Development that dominated the global debate thus far.

From Save the Whales to Gaia Inc. to Business as Usual and the fork in the road

The first iteration of Sustainable Development can be called the 'Protect & Save' model. This model was popularised by Greenpeace, Friends of the Earth and other activist groups, had a strong environmental and human rights focus, led to a number of international environmental and human rights treaties, and gave us the ideology of Deep Ecology (See Sessions, 1995 for an in depth discussion on Deep Ecology). The initial focus was on saving charismatic endangered species like pandas, whales, elephants and butterflies, and assigning 'rights' to animals. This focus later broadened to protecting general biodiversity by protecting

endangered habitats like wetlands and rainforests. Socially it was about saving people from oppression and discrimination, protecting vulnerable minorities and protecting communities against the effects of pollution. Economically it was about saving people from poverty, hunger and ‘underdevelopment’. This last aspect opened the door to both the next iteration and the first major fork in the road.

The second iteration of sustainable development had a more utilitarian approach, made possible when, in 1987, the economy was taken out of its place as a part of the human-environment relationship, to become a separate pillar of sustainable development. This step gave the world the famous three pillars model of economy, society and environment, first described by Barbier (1987). While subsequent thinkers have added pillars such as technical, political, or institutional (see for example Hill and Bowen, 1997), the three pillar idea stuck. It was morphed by the World Business Council on Sustainable Development into the triple bottom line of ‘people, planet and profit’, and continues to inform the indicators of sustainability assessment initiatives, both in business and in buildings.

Giving the economy its own voice, and then interpreting the economic pillar to mean profit (read shareholder interests), opened the door not only to the interests of business but also to the management practices of business. The dominant terminology in this iteration - trade-offs, improved efficiency, indicators, performance standards, and valuing ‘eco-system services’- is straight from the management handbooks of the 1980s and 1990s and is encapsulated in management guru Peter Drucker’s famous dictum that “if it can’t be measured, it can’t be managed”. In addition, the language of this model points to the strong influence of a worldview that considers both nature and humans as economic commodities to be traded at the stock exchange of global development. In a move predicted by Polanyi [1], the three pillars became the triple bottom line and then the five capitals, the planet was turned into Gaia Incorporated, and every interaction between humans and the biophysical environment became a financial transaction in which humans are the (short-term) winners and sustainable

development is seen as mainly an accountancy problem to be solved by the new economic model of sustainable capitalism (Elkington, 1998). As long as a business case can be made and the bottom line(s) balanced (through exchanging 'natural' capital for other types of capital, determining 'fair shares', trading my carbon pollution for your pristine forest credits, etc.) it is assumed that development will be sustainable.

The Gaia Inc. iteration of sustainability eventually led to a fundamental ideological split within the international sustainable development discourse. Going in one direction are those who see sustainable development as a process of ensuring that current modes of development can be sustained. Although the warning signs had been there since the Rio Earth Summit in 1992, the World Summit on Sustainable Development in 2002 was the watershed where those in favour of 'sustained development' won out over those in favour of 'sustainable development'. The emphasis of strategies such as the UN Millennium Development Goals, the WSSD Johannesburg Plan of Implementation, and in Africa, the New Partnership for Africa's Development (NEPAD), is on development through (neo-liberal) economic growth. The result is delivery wish lists based on a specific cultural interpretation of development and what constitutes acceptable economic models, underpinned by powerful commercial and political interests that convinced the world that what 'sustainable development' needed was more development. Thus what is currently being promoted as 'sustainable development' by the UN and most governments, is nothing more than the standard developmental mantra of the past 50-odd years, with a few environmental components tacked on. Sustainable development has become sustained development and entered the halls of Business as Usual, safely co-opted by the global development programme as predicted by Sachs (1993:29) and Satterthwaite (1999:101-104).

However, another stream of thinking kept the momentum going. Driving this iteration is the understanding that we are operating in a context of finite resources and limited sink capacities, and that if we want continued economic growth to meet the ever-expanding

needs of human development in an equitable manner, we need to do more with less. This led to the 'Eco-efficiency' iteration of sustainable development as driven by proponents including von Weizsacker, *et al* (1997), Munasinghe (2001), and to some extent Hawken, *et a*l (1999). This iteration proposes a subtle gear shift that results in broad improvements to current development models, (e.g. the concepts of Factor 4 and 10 efficiency, sustainomics, and natural capitalism), without questioning too deeply the fundamentals of the current development paradigm. It is also linked to the concept of eco-system services, used by the Millennium Ecosystem Assessment to determine not only the global state of the environment, but a way of placing economic value on the biophysical environment.

The main concerns of this model are to reduce the negative impacts of development and growth, and to increase the efficiency with which we are using resources, while reducing the inequities in our socio-economic system. Within this model the management of the human-biosphere relationship was seen as a matter of determining limits and then living within these limits (e.g. ecological footprints, fair shares, sink and source capacities, Factor 10 efficiency) – in other words, how much damage can we get away with? There are two fundamental flaws in this model. The first is that the language and concepts of the model leads automatically to the calculations of quantitative limits and monetary values of the different forms of capital. This presupposes the possibility of accurate predictions of such limits and that everything can be reduced to a monetary value. However, there are also qualitative and normative limits to current models of growth and development that are impossible to predict, let alone quantified or priced in currency of any sort.

The second flaw is that it still fails to address the fundamental nature of the current adversarial and eventually mutually destructive relationship between humans and their biophysical environment. Our efforts at unrestricted economic growth are outstripping our efforts at resource efficiency and impact reduction. As Rees (1999:40-41) pointed out, '*The growth ethic has finally engaged biophysical reality. Even the factor-10 economy, while*

clinging to the technological fix, is a singular concession to the ecological imperative now confronting humanity'. While eco-efficiency may prolong the agony a bit, it is not enough to turn the Titanic and if we continue to pursue our current development path we will eventually progress to systems collapse as warned by the Millennium Ecosystem Assessment (2005) and Gallopin, *et al*, (1997).

As pointed out in the Introduction, the currently dominant iterations of sustainable development have not been successful in making enough of a difference to prevent the large-scale deterioration of the ecosystem services on which the human species rely for survival. While there have been definite improvements in some areas, these are not sufficient to change the negative course of the current development trajectory. In fact, the wins achieved through the earlier iterations of sustainability can create a dangerous sense of complacency – just because the pain is perceived as less does not mean that the cancer is cured. As William McDonough puts it: "Doing a bad thing less bad, doesn't make it good" (McDonough, 2004). So where to next?

Paradigm shifts and quantum leaps

Up to this point, sustainable development models were rooted in the uncritical acceptance of the dominant worldview based on a deterministic, mechanistic understanding of nature (Capra, 1996:5; Rees, 1999: 24-26) and guided by '*progressive, secular materialism and the institutions associated with that worldview*' (Worster, 1995:425). The whole idea that a protocol for sustainable development can be defined, harks back to the ideas of the Enlightenment that Man can (and should) control (and preferably conquer) nature and, through technology and science, address the problems imposed on human society by the "external limits" of nature (Redclift and Sage, 1994:17). A second feature of the mechanistic paradigm is that it sees the earth as a machine, the behaviour of which could be analysed and understood in terms of the properties of its parts. This view was taken further to mean

that the parts can be addressed separately, with the assumption being that if all the individual parts are in place and working, the whole will be sustainable. And because everything can be measured, it should be possible to determine when we have arrived at sustainability and what indicator values will add up to this ideal of sustainability.

Added to this is the voice of the pragmatists who cautioned against rocking the boat lest important stakeholders such as the business sector take fright; who advocated an evolutionary approach (seen as gradual incremental change) as opposed to a revolutionary approach; and who sensibly suggests to focus on what can be done within the current system, instead of on what needs to be done. All of these factors served to impede the development of a truly innovative and creative response to the challenge of sustainable development.

However, it is becoming clear that the mechanistic approach to sustainability is failing because its linear, reductionist methodologies cannot foresee or address the unintended consequences inherent in the complex dynamic systems that constitute life on Earth. Furthermore, the approach of continuous improvement through incremental changes to the existing worldview and its development practices is not enough to stem the tide, and what is required is a quantum leap – a change to a different system state. More and more commentators (e.g. Schumacher, 1974; Naess, 1995; Sachs, 1995; Devereux, 1996; Capra, 1996 and 2002; Bossel, 1998; AtKisson, 1999; Kumar, 2002).are pointing out that for humanity to move into a positive curve towards sustainability, society needs to change the paradigm within which it operates.

In fact, such a paradigm shift appears to be happening already and sustainable development can be seen as both a driver and a result of this shift. This new paradigm (referred to as the ecological paradigm by Capra, 1996, and the Reflective/Living Systems Paradigm by Elgin, 1997) implies a shift towards a worldview that recognizes '*the fundamental interdependence*

of all phenomena and the fact that, as individuals and societies, we are all embedded in (and ultimately dependent on) the cyclical processes of nature' (Capra, 1996:6). Rees (1999:24-27) provides an in depth comparison between the current expansionist/ mechanistic worldview and the ecological worldview.

The ecological paradigm builds on discoveries and theories from fields as diverse as theoretical physics, complex systems sciences, ecology, biology, psychology, sociology and comparative religion. Developments in these disciplines, coupled with advancement in transport, information and communication technologies, as well as an increasing awareness of global interconnectedness through both ecosystems and economic systems, are all factors contributing to the emergence of a new worldview that is based on two major shifts in thinking:

a) from reductionist thinking to relational, whole systems thinking; and

b) from Man as separate from and in competition with nature to Man as part of and co-evolving with nature.

The notion that sustainable development should be seen as a whole systems response to the complex systems problems found in the interconnected and interdependent relationships that determines the interactions between humans, their society, economy and technology, and the biosphere, is well supported in the literature (e.g. Girardet, 1996; Wilber, 2001; Hawken, *et al*, 1999; Rees, 1999; Capra, 2002; McDonough and Braungart, 2002). It is a concept that, while fairly new, can be supported by current scientific developments, especially in the study of quantum physics, complexity theory and complex adaptive systems, and the science of ecology.

The one consistent message that comes from all these diverse disciplines is that everything is interconnected and interdependent. In quantum physics this interconnectedness is found in the ground state field of energy constantly unfolding and enfolding all of reality as we

perceive it – the so-called Zero Point Field or quantum energy field. Research is indicating that all matter in the universe is connected at a sub-atomic level through the Zero Point Field (Puthoff 1989, Haisch, *et al* 1997, Haisch, 2002). Chaos theory brings this interconnectedness into 'real' life systems (from the weather to stock markets and traffic jams) by showing that a small change in input somewhere in the system (the proverbial butterfly flapping its wings) can have a profound effect at another point in the system (a storm somewhere else two weeks later). No act happens in isolation, and no act happens without influencing the system within which it happens. At an even larger scale, the Gaia hypothesis of Lovelock (1979) and Margulis (1998) illustrated this interconnectedness and interdependence by applying systems theory to ecology. In a semi-closed system like the planetary biosphere, the actions of elements in that system will always eventually influence the actor in a balancing process (lots of grass means lots of bunnies, lots of bunnies means less grass, less grass means fewer bunnies, fewer bunnies means more grass…). In psychology, this concept of interconnectedness can be found in the Jungian idea of the collective unconsciousness and in neuroscience in the ideas of Laughlin(1996) and Pribram (1991; 1993) that memory does not reside in the brain, but in a 'universal information field' from which our brains retrieve memory and information.

However, it is the second shift in thinking that will have the most profound effect. But this is also the most difficult shift to achieve, as it requires a quantum leap towards a different state of consciousness that transcends the dualistic tensions between humans and nature inherent in the current worldview that sees humans and nature as separate from and in competition/conflict with each other. The 'ecological paradigm' requires that our definition of development shifts from the successful domination of nature, forcing it to follow ideas of order that ignore its inherent systemic properties, to embracing nature and participating in and co-evolving through its processes (Lyle, 1994; Eisenberg and Reed, 2003). In the words of that *éminence grise* of the environmental movement, Wendell Berry:

'*We have lived by the assumption that what was good for us would be good for the world. We have been wrong. We must change our lives, so that it will be possible to live by the contrary assumption that what is good for the world will be good for us. And that requires that we make the effort to know the world and learn what is good for it. We must learn to cooperate in its processes and to yield to its limits'* (cited in Hawken, et *al*, 1999: xiv)

As such, the ecological paradigm introduces a different way of being and a different value system, based on a different kind of relationship between humans and both their social and physical environments. It is important to realise that this is not necessarily a totally new worldview – elements of it can be found in all non-Western cultures (and even some of the earlier, pre-Christian European cultures). Capra explains at great length throughout his entire oeuvre that the notion of interconnectedness, of being part of Indra's web of life (what Ghandi described as the essential unity of all that lives) is a central quality of Eastern mysticism. The work of Devereaux (1996), Voigt and Drury (1997), Ingold (e.g. 2000), Trugden (2000), and McGaa (2004), amongst many others, points to an understanding amongst indigenous peoples of being part of the landscape; of the Earth and the World being the same thing, of people and nature as being *knowingly* interconnected and interdependent (holding the relational total field image, as Arne Naess described it). The notion of interdependence is encapsulated in the Sanskrit 'So Hum" (Kumar, 2002) and the Southern African concept of Ubuntu (Broodryk, 2002; Shutte, 2001) - both implying that "I am, because you are".

The traditional African worldview provides a good example of how this sense of interconnectedness influences the meaning of relationships. Reality is not seen as a world of material objects, but as a field of interacting forces. These forces are physical, emotional, creative or intentional, and spiritual. Everything that exists: rocks, plants, animals and humans are the expression of the interaction of these forces. As such everything we experience as matter has life-force or *seriti*. Rocks just have less *seriti* than humans. *Seriti* is

generated or reduced through relationships and the quality of those relationships. Each individual person is seen as the focus of shifting forces, changing as they change, existing only as part of the different relationships that binds us together. As such, a person exists only in relation to others. Newborns and strangers are considered to be in a state of 'potential' personhood until they are included in relationships that will turn them fully human. Because a person's becoming (and remaining) human relies on relationships with others, it is inconceivable for an individual to fully separate his or her existence from that of the community. Literally, I am because we are. And the community includes everything, because everything has life-force and can therefore strengthen your own life-force by entering into a relationship with you. (Shutte, 2001)

This paradigm shift is creating a new landscape not only for scientific and technological development, but also for the form and processes of the built environment from construction and infrastructure provision to operation and management, aiming for a future where our species leaves "*an ecological footprint to delight in*" (McDonough and Braungart, 2002:16). How exactly this is to be achieved is the quest of the next generation of sustainability iterations that are appearing. Although these have not yet developed into a cohesive body of work, it is possible to identify the early commonalities as discussed below.

From Cooperative Regeneration to Co-evolution

The realisation that attempting to reduce negative human impact on the biophysical system is not enough to build an alternative and sustainable development trajectory, provided the impetus for the next iteration of sustainable development that begins to ask how humans can use the regenerative strategies of nature (Lyle, 1994) to reverse the degeneration caused by industrial development (Eisenberg and Reed, 2003) and have a net positive impact on nature. This emerging iteration of sustainable development sees a shift away from the either/or (people or planet) approach to one of development through Cooperative Regeneration – people working with nature to restore and maintain ecosystem health and communities

working together to restore the social fabric. It goes back to the *Cocoyoc Declaration*'s vision of a co-operative world of networked settlements, in partnership with nature, and in solidarity with future generations; but to design this world it draws on an understanding of the properties and processes of life. It suggests that learning how to obey natural laws and work with nature as co-creators of the environment is not just useful, but absolutely necessary.

The Cooperative Regeneration model is the first step towards a developmental model that aligns human development efforts with the creative efforts of nature. Early models of this approach can be seen in the permaculture movement, organic agriculture, and John Todd's living machines. Examples of cooperative regeneration are becoming more common in other fields as well. In the USA, consultants *Natural Logic* are overseeing the development of a new town planned for 100 000 inhabitants in central Arizona which will, by restoring the original dry grassland prairie, provide more available water to the surrounding communities than there had been without the presence of the new inhabitants (http://www.natlogic.com). In Las Gaviotas in Colombia, settlers have managed to turn a *llanos* desert into a forest by using the principles of regenerative cooperation between humans and nature (Weisman, 1995).

It may be possible to create a future where the damage done to the biosphere and to our social systems have been restored, and people can live in mutually supportive symbiosis with their social and biophysical environment (their whole ecological system) – the one nurturing the other. McDonough and Braungart (2003:14) epitomises this thinking when they ask us to imagine

> *"buildings that make oxygen, sequester carbon, fix nitrogen, distil water, provide habitat for thousands of species, accrue solar energy as fuel, build soil, create microclimate, change with the seasons and are beautiful" – just like a tree."*

However, as Eisenberg and Reed (2003) warns, it would be wise to exercise some humility about our ability to understand and 'manage' natural systems, and understand that they cannot be managed as though they are machines or businesses that can be dealt with in a way that will make them act in a uniform, predictable manner. We should also guard against an interpretation of the ecological metaphor that attempts a superficial (or worse, merely aesthetic) reproduction of nature to solve one 'problem' in an otherwise conventional product or process, or a rearrangement of current harmful processes into 'closed-loop' systems. Changing to an ecological paradigm does not just mean a shift in technology and materials, but also an epistemological, and eventually, an ontological shift for which there is no precedent in the current worldview.

The question that concerns this paper is how does this shift towards an ecological paradigm influence thinking around sustainable building and construction?

Sustainable building in the new ecological paradigm

While space does not allow a proper discussion of the ecological paradigm, it can be understood as built around at least the following precepts:

- That the world is a complex, interconnected and finite system (Meadows, 1982:101).
- That the world is a 'living' system which, to be 'sustainable' has to be healthy, viable, adaptive and self-organising (Sterling, 2003:37).
- That humans see themselves as a part of nature and recognise the dependence of their species on the ability of the biosphere to continue providing the vital services that supports human life (Millennium Ecosystem Assessment, 2005). 'Environmental' issues are therefore not separate from social or economic issues.
- That humans exist within a social-ecological system (Walker, *et al*, 2002; Anderies, *et al*, 2004) that consists of the noosphere (thought and cultural production) and the biosphere

(of which the human species and its physical activities is one part), where the 'noosphere includes and transcends the biosphere' (Wilber, 2000:30).

- That our definition of development shifts from the successful domination of nature, forcing it to follow ideas of order that ignore its inherent systemic properties, to embracing nature and participating in and co-evolving through its processes (Lyle, 1994; Eisenberg and Reed, 2003).
- That nature and its structures and processes provide a better root metaphor to inform human structures and processes (Todd and Todd, 1993; Lyle, 1994; Benyus, 2002; Eisenberg and Reed, 2003) than the currently dominant mechanistic metaphor.

Seeing the built environment as another of nature's biological systems (created by organisms within a biological environment using both organic and inorganic matter to feed its growth and create the structures which it contains), opens up a number of different avenues for approaching sustainability in building and construction, some old, some new.

Kibert (2006), equating ecological building with green or sustainable building, describes three versions of ecological design. Strong ecological design based on principles of biomimicry and cradle-to-cradle design; weak ecological design based on minimizing lifecycle impacts; and intermediate ecological design based on the synergistic integration of built environment systems with ecosystems. He holds that while weak and intermediate design may be possible and beneficial, strong ecological design is not achievable, as humans will never be able to understand ecosystem functioning sufficiently well to replicate nature, and in addition, will not constrain themselves to developing only those materials and systems for which there is a precedent in nature.

This somewhat cynical dismissal of strong ecological design is in itself the product of old paradigm thinking. Firstly, these versions of ecological design are not in opposition (an old paradigm view) but, like the sustainable development iterations, are actually evolutionary

stages enfolded in each other (a new paradigm view). Strong ecological design does not oppose or discard the rules of weak ecological design, but rather provide new ways of following these rules. It is therefore not a matter of which version should be supported, but rather how best to maintain evolutionary momentum.

Secondly, strong ecological design is not about replicating nature, but about learning from and working with nature, letting nature do the work as Lyle (1994) suggests. Biomimicry is first and foremost a method of inquiry that asks questions such as: in this particular time and place how would nature solve this particular problem? (Benyus, 2002) And then to listen to the answer with respect and humility. The very notion that replicating ecosystem functioning is a valid pursuit, is in itself old paradigm thinking.

Thirdly, there is no reason while human ingenuity cannot be channelled into developing more life-friendly materials and systems. Note that it is the concept of life-friendly that is important, not whether there is a natural precedent for it. If humans are to be considered as co-evolutionary members of the community of life, there is no reason why they cannot create new materials and systems, as long as these are life-friendly.

There are, however, major differences between what Tansey (2006) refers to as old ecological thinking and new ecological thinking. Old ecological thinking still falls in the trap of replacing one mechanistic approach with another. Ecosystems are described as though they follow a linear evolutionary process towards a steady-state climax community; and as closed, localised systems with circular metabolisms that results in no waste and maximum resource efficiency. Sustainability, from this perspective, is about maintaining the steady state of mature communities (balancing the triple bottom lines as advocated by, for example, Elkington, 1998 & 2004, or the capital stock, as advocated by Pearce, *et a*l, 1989, and the Forum for the Future, Wilsdon, 1999) and allowing other communities (such as developing countries) to mature to stable climax communities. It also falls in the reductionist trap of

presuming universally applicable ‘rules of nature’ that, if applied to developmental and technological interventions, will make their outcomes ‘sustainable’. This approach is quite apparent in the formulaic nature of the most common principles and approaches for ecological design discussed by Kibert (2006). While there is a lot of truth in these ‘rules of nature’, applying them unthinkingly as one-size-fits-all checklists or general design principles holds its own danger. They are, once again, just a further piece of the puzzle.

New ecological thinking, in turn, builds on the past and adds its own puzzle piece to the big picture. It expands the ecological metaphor to acknowledge not just the flows of matter, energy and information within the system (the ‘economy of nature’ that formed the conceptual foundation of the capitals theory and early industrial ecology), but also the importance of context and relationship, as well as the fundamental role of change and adaptability in an essentially unknowable larger system. Commentators such as Kay (2002), Allen (2002) and Peterson (2002) provides a broad introduction to the currently fashionable concepts of the ecological metaphor such as resilience, non-linear system dynamics, adaptive management, and emergence and how these can apply to building and construction.

This newest iteration of ecological design brings many new ideas to the table that have still not been fully explored in theory, let alone in practice. They will impact on the processes and design/structure of the built environment at all scales and all stages of the construction life-cycle. However, there is a real danger that the ecological metaphor too can be co-opted by opportunistic players to become a superficial veneer on an otherwise conventional product or process. The temptation will be great to apply literal interpretations of ecosystem behaviour to building and construction, and to architects, an even greater temptation is to express this as an aesthetic metaphor (as described by Jencks, 1995) and not as a functional application as Eugene Tsui (1999) attempts to do. However, such superficial applications are not only pointless, but can be detrimental to the sustainability objective if there is no ‘full, integral

participation with place and nature as co-creators' (Reed, 2004). What exactly this would require, will be the main question guiding the next iteration of ecological design.

Conclusions

John Elkington (1998) refers to the Polish poet Stanislaw Lec's question whether it is progress if a cannibal learns to eat with a knife and fork. Elkington argued that it is indeed progress, citing the example of shifts in business (and by extension capitalism) towards greater social and environmental responsibility. The fact that Elkington could even make such an argument, perfectly illustrates why it has become necessary to rethink our approaches to sustainable construction. For the past ten years, the focus has been on improving the table manners of the cannibal, instead of changing the practice of cannibalism. If, however, we are to think beyond the day after tomorrow, to the legacy current generations will be leaving those of the seventh generation to follow, we seriously need to put an end to the practice of cannibalism [2]. To do this, we need to recognise that we have in fact been eating ourselves, and that this is not only a stupid thing to do, but continuing to do so, only in smaller, sanitized and more efficient bites and expecting the pain to go away, is nothing less than insanity.

The brutal truth is that during the past ten to fifteen years, the contribution of sustainable construction to the global sustainability project has been negligible, despite the fact that the built environment is the single biggest anthropogenic contributor to resource consumption and greenhouse gas emissions. Yes, there has been progress, but this has been off a very small base. After all, anything is better than nothing. However, if mainstream sustainable building and construction remains stuck in the Gaia Inc. and Eco-efficiency models of sustainable development, we will miss the small window of opportunity left in which to avoid systems collapse. These models are simply not geared to encourage innovation outside the norms acceptable to the market (whether this be industry or society). If we want radical green

buildings (to quote Kibert, 2005), we will have to become more radical in our thinking, more daring in our creativity, and more idealistic in our visions of what a sustainable built environment can look like.

The alternatives opened up by a shift to an ecological view of the world provide a starting point for such radical creativity, for envisioning a built environment unlike anything we know now. Yes, there are many obstacles to the ultimate goal of creating buildings like trees and cities like forests, some are technical, many are perceptual, and even more are cultural. Even a simple change in perception that recognises the built environment as the human equivalent of the structures of nature such as anthills, coral reefs or beaver dams is difficult to achieve. It is perhaps this necessary shift in perception from humans and environment as separate, to humans and environment as one entity, that will prove to be a bigger obstacle to the adoption of strong ecological design than any of the more pragmatic reasons offered by commentators such as Kibert (2006). The sad thing is, to create the conditions favourable to such a fundamental change in the social system, we may very well need to have a systems collapse first. This too seems to be a rule of nature (see Gunderson and Holling, 2002).

End notes

[1] Karl Polanyi in his book *The Great Transformation* (1944*)* described the monetization of society through a mercantile economy as a process through which: “Man, under the name of labour, and nature, under the name of land, were made available for sale.”

[2] It is acknowledged that in some cultures cannibalism is considered a perfectly acceptable cultural practice and my sincere apologies to any cannibals who are offended by this analogy.

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