Motivating change: shifting the paradigm[1]

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Abstract
The broader framing of the decision-making processes of stakeholders within the sustainability debate is explored in the context of a paradigm shift that acknowledges the world as a complex, dynamic system. There is merit in adopting a paradigm informed by, and therefore suitable for dealing with, living systems, particularly as the paradigm is founded on holistic and flexible strategies. To move the discussion forward, a key concern examined here is what this different paradigm means for engaging and motivating stakeholders. Through questioning established notions of ‘stakeholder’ as defined in the business literature, and the traditional models of sustainable development, an alternative model of sustainability is presented that is grounded in a different worldview. The implications are considered of how the paradigm’s adoption and the associated model of sustainability would change current practices for motivating social transformation in the built environment through stakeholder engagement. Three major shifts in thinking implicit in such a new model of sustainability are identified and examined: creating effective change in the complex social–ecological system presented by the built environment; how this worldview would redefine current notions of stakeholder engagement; and what the implications would be for mechanisms such as assessment and rating tools meant to change stakeholder behaviour.

Keywords: assessment, buildings, built environment, complexity, paradigm shift, regenerative, stakeholders, sustainability, whole systems

Introduction
This special issue of Building Research & Information is framed around motivating stakeholders to embrace the changes required for the creation of a sustainable built environment. In their paper, elsewhere in this special issue, Feige, Wallbaum and Krank describe the current status of stakeholder involvement in sustainable design and construction and the effectiveness of existing mechanisms aimed at driving behaviour change in the construction sector. They identify a variety of current instruments ranging from regulations and incentive schemes to voluntary agreements and decision support. Inspired by Donella Meadows’s work on effective leverage points in a system (Meadows, 1999), this paper proposes that stakeholder behaviour change can be more effectively and permanently motivated through a shift in paradigm, and explores how such a shift could redefine key concepts and approaches to stakeholder engagement.

A paradigm can be defined as the shared values, concepts and practices of a community as shaped by the particular view of the world held by that community (Kuhn, 1996, p. 42; Capra,

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1997, p. 6; Wilber, 2000a, p. 282). Although originally used to describe the practices of a scientific community (a scientific paradigm), the term is also used to refer to the practices of society (a social paradigm). A broad range of commentators (e.g. Schumacher, 1974; Sachs, 1995; Capra, 1997, 2002; Bossel, 1998; Atkisson, 1999; Hawken et al., 1999; Rees, 1999; Raskin et al., 2002; Adams, 2006) suggest that for humanity to transition towards sustainability, it needs to change the paradigm within which it operates – shifting from the current one framed by a mechanistic worldview to one informed by a whole/living systems worldview.

Evidence is emerging that this shift to a new worldview is already happening (Ray and Anderson, 2000), one which Hawken (2007, p. 4) describes as the greatest social movement in history, involving millions of organizations across the world. This social transformation is happening at many levels and through both diffusion, as more and more actors adopt new values, practices and technologies until it becomes mainstream, and transferring of ideas through actor-networks such as that described by Latour (1986). Raskin (2010) describes this as the Widening Circle model in which a growing social ecology of actors engages in developing, refining and manifesting a new, sustainable way of engaging with the world.

The purpose of this paper is not to provide a detailed discussion on the various merits of and tensions between the mechanistic and whole/living systems paradigms since this has been adequately covered in the literature (e.g. Lazlo, 1987; Capra, 1983, 1988, 1997; Berry, 1990; Rees, 1999; Elgin and Le Drew, 1997; Wilber, 2001; Suzuki and McConnell, 2002; Sterling, 2003; Wheeler, 2004). This paper accepts that there is merit in adopting a paradigm informed by and therefore suitable for dealing with living systems, and attempts to move the discussion forward by examining what this different paradigm means for engaging and motivating stakeholders. The discussion that follows briefly delineates the characteristics of such a whole/living systems paradigm and then poses the following questions:

- How can effective change be created/managed from within this paradigm?
- What are the implications for how stakeholders are identified and their roles defined?
- What are the implications for current incentive practices, particularly assessment and rating systems used to measure and monitor compliance/progress?

Answering these questions, individually and collectively, points to the necessity of re-inventing a number of concepts and practices associated with, and which guide, building design and construction.

Characteristics of a whole/living systems sustainability paradigm

The philosophical enquiry in this paper questions the established notions of stakeholder as defined in the business literature, and the traditional models of sustainable development such as the three pillars model proposed by Barbier (1987) and the World Commission on Environment and Development (WCED) (1987), or the five capitals model (Pearce et al., 1989; Serageldin and Steer, 1994; Parkin, 2005), both of which are grounded in the currently dominant mechanistic worldview. It does so by holding up an alternative model of sustainability grounded in a different worldview and asking how its adoption and associated model of sustainability would change current practices aimed at motivating social transformation in the built environment through stakeholder engagement.

A worldview can be described as a collection of concepts, theorems and assumptions that provides a coherent (but not necessarily accurate) way of looking at and thinking about the world (Kearney, 1984, p. 41; Aerts et al., 2007, p. 8). Kearney (1984), Cobern (1989) and Aerts et al. (2007) propose that included in a worldview are descriptions of the structure, function and nature of the world, as well as general theories of value, knowledge and action which form the basis for the scientific and social paradigms congruent with that particular worldview. Although the terms 'worldview' and 'paradigm' are frequently used as fully interchangeable notions, a shift in worldview is prerequisite to a paradigm shift.

The mechanistic worldview operates on an assumption that the properties of the whole can be reduced to and deduced from the sum of the properties of the parts (as is possible with mechanical and other complicated cybernetic systems). The 'ecological' worldview, by contrast, holds that the properties (and behaviour) of the whole are more than the sum of, and not deducible from, the properties of the parts, i.e. 'holistic' (as found in complex and living systems) (Capra, 1997; Rees, 1999; Sterling, 2003). However, it can be argued that the above differences should not be seen as oppositional, but rather as evolutionary, with the new worldview including the knowledge and insight accumulated through preceding worldviews and then transcending these to form a new worldview (Wilber, 2000b, p. 58). This argument is the basis for a whole/living systems worldview that includes both mechanical and ecological views, using the tools and insights of both at the appropriate system level to develop theories of value and action that transcend the limitations inherent in these worldviews.

Three shifts in thinking influence the sustainability paradigm offered by the whole/living systems worldview.

The shift from complicated to complex adaptive systems

Boulding (1956), in his hierarchy of systems, differentiates between lower-level systems associated with matter and higher-order systems that include life. Lower-level systems (such as clockworks or cybernetic systems) may exhibit dynamic properties and include feedback mechanisms aimed at maintaining equilibrium, but they are essentially complicated systems. In complicated systems:

> "the various elements that make up the system maintain a degree of independence from one another . . . removing one such element (which reduces the level of complication) does not fundamentally alter the system's behaviour apart from that which directly resulted from the piece that was removed" (Miller and Page, 2007, p. 9).

In complex adaptive systems, the elements of the system are interdependent to such an extent that the removal of one element destroys or fundamentally alters system behaviour "to an extent that goes well beyond what is embodied by the particular element that is removed." (Miller and Page, 2007, p. 9).

A further characteristic of complex adaptive systems is that unlike mechanical systems, where systems and parts have fixed functions that either work or do not, adaptive systems have flexible functions that adjust to the context of their environment and which allow them to self-organize in order to optimize the functioning of the system, creating new niches as necessary, and changing their composition to fit the changing patterns they encounter (Lucas, 2004, p. 2). These adaptive responses and interactions allow the system as a whole to undergo spontaneous self-organization into collective structures with properties that cannot be predicted from the properties of the parts, and which the agents may not have possessed individually (Waldrop, 1992, p. 146) – a concept referred to as emergence. In addition, the dynamics within these systems are non-linear, which implies that small changes can have large, unexpected results; the system operates far from equilibrium and exhibits hysteretic or irreversible behaviour, i.e. it may resist change up to a certain threshold point at which it flips irreversibly into a different state. These systems are constantly in transition and thus characterized by perpetual novelty, calling into doubt the idea that the behaviour of any agent can be optimized (Waldrop, 1992; Holland, 1996; Finnigan, 2002; Miller and Page, 2007).

Buildings, as functional (as opposed to aesthetic) artefacts, are traditionally complicated systems, as they are reducible to their parts and the result of removing a part can be predicted. The recent introduction of intelligent building automation means that buildings have the potential to become adaptive, but still complicated, systems. Complexity is introduced at the building level when the building is no longer perceived as merely a physical artefact, but rather as a process that involves interactions between natural laws, biophysical systems and the actions of their human occupants, i.e. the building is recognized as a social–ecological system in itself. Cities, however, are outright complex adaptive systems (Holland, 1996, p. 11; Batty, 2005, p. 107). Removing or changing any of the parts (subsystems) that constitute a city (its transport, energy or water infrastructure networks; its sum of buildings; its economy; its inhabitants; or its particular environmental endowments) will result in fundamental and unpredictable change to the entire urban system's behaviour.

The shift from an equilibrium to a non-equilibrium model

In an equilibrium model, ecosystems are described as though they follow a linear evolutionary process towards a steady-state climax community. As closed, localized systems with circular metabolisms that self regulate into an equilibrium state they are seen as resulting in no waste and maximum resource efficiency (Alberti et al., 2003; Tansey, 2006). This model underlies notions such as material and energy flow accounting (e.g. Odum, 1967, 1997, 2002; Haberl et al., 2004; Moffat and Kohler, 2008) and urban metabolism (Wolman, 1965; Boyden et al., 1981; Girardet, 1996). A non-equilibrium model, by contrast, sees ecosystems as open, dynamic and highly unpredictable, process-driven and often regulated by external forces, not necessarily internal mechanisms (Alberti et al., 2003). Implied here are two additional shifts. Firstly, a shift from viewing the world as a predictable complicated system aiming for balance or homeostasis to one that is unpredictable and constantly changing, complex and adaptive. Secondly, a shift from desiring a steady state and conservation of the status quo, to accepting the inevitability of change and an emphasis on adaptation and resilience.

The shift from an anthropocentric to an eco-centric worldview

Capra (1995) describes the current dysfunctional relationship between humans and the biosphere as indicative of an anthropocentric worldview that sees humans as above or outside of nature, as the source of all value, and ascribing only instrumental or use value to nature. The other option, he suggests, is an ecocentric view, which regards the world as 'a network of phenomena that are fundamentally interconnected and interdependent' (Capra, 1995, p. 20), where the world is not regarded as a collection of isolated objects and humans are not seen as separate from nature, but as a tightly coupled co-evolutionary social–ecological system. The Resilience Alliance (2006) defines social–ecological systems as ‘complex, integrated systems in which humans are part of nature’. Moffat and Kohler (2008, p. 248) suggest that understanding the built environment as a complex social–ecological system is a necessary requirement for building a unified theory of the built environment. In response, du Plessis (2009a) proposes a four-part framework for seeing cities as social–ecological systems that span across biophysical, social and human mental phenomena, and consist of relationships between elements at a number of scales and within nested systems. A key implication here is that addressing stakeholder engagement therefore has to happen at all scales of the built environment, from cities to buildings and materials, and at spheres that include biophysical and social and institutional systems, as well as intangible phenomena such as beliefs, norms and values.

It is inevitable that these three shifts will also influence how sustainability is understood and the manner in which it subsequently drives human actions and strategies. As Haberl et al. (2004) point out, a consensus seems to be forming that sustainability is a problem of the dynamics in social–ecological systems and this offers a different perspective to:

> the simplistic idea that sustainability can be achieved by adding a third, ‘environmental’ dimension to the classical policy goals of improving economic performance and social well-being. (p. 200).

This perspective sees a shift in the definition of development from the successful domination of nature to one that embraces nature and participates in and coevolves through its processes, i.e. development through cooperative regeneration, with people working with nature to restore and maintain ecosystem health and communities working together to restore the social fabric (du Plessis, 2006). Birkeland (2008, p. xv) characterizes this as where human physical development efforts would achieve:

> net positive impacts during [their] lifecycle over pre-development conditions by increasing economic, social and ecological capital . . . leaving the ecology better than before development.

Reed (2007, p. 675) suggests that in a sustainability paradigm informed by whole/living systems thinking, the purpose of sustainability is to sustain and regenerate life-enhancing conditions through approaches that engage and focus ‘on the evolution of the whole of the system of which we are part’ (Reed, 2007, p. 677).The arguments presented above reintroduce the principles of the Cocoyoc Declaration that called for a ‘cooperative world in partnership with nature’ (United Nations Environment Programme/United Nations Conference on Trade and Development (UNEP/UNCTAD), 1974, p. 6). Such a perspective begins to ask how humans can use the regenerative strategies of nature (Lyle, 1994; Reed, 2007) to reverse the degeneration caused by industrial development (Eisenberg and Reed, 2003) and have a net positive impact on nature (McDonough and Braungart, 2002; Birkeland, 2008). It further gives power to the currently voiceless and marginalized stakeholders in communities by acknowledging the energy and power of self-organization and therefore of the role these communities play in shaping the built environment.

The idea of the world as an ever-changing, impermanent and inherently unpredictable process of being and becoming is also shifting the interpretation of how sustainability should be defined. Murray Gell-Mann (quoted in Waldrop, 1992, p. 351) suggests that a sustainable human society would be ‘adaptable, robust, and resilient to lesser disasters, learn from mistakes’, and one that ‘isn’t static, but allows for growth’. Yorque et al. (2002, p. 436) warn against views of sustainability ‘that have a static quality’ and suggest instead a view of sustainability that ‘stresses adaptability and learning through thoughtful probing’.Holling et al. (2002, p. 76) suggest that ‘sustainability is the capacity to create, test and maintain adaptive capability’. From these perspectives, resilience is the key to determining sustainability in social–ecological systems (Walker and Salt, 2006, p. 11; Brock et al., 2002, p. 270).

The foregoing propositions also represent a profound change for current design and construction practice and raise a host of questions, including: How can sustainable construction respond to the challenge? How will building design, construction, use and deconstruction manifest in a systemic paradigm? Joh (2006, p. 90) suggests two possible approaches:

- an ecological design and engineering strategy which literally applies biological characteristics to the built environment to create technical systems that function as parts of the biological ecosystem
- the development of a different design process that allows planners and designers to integrate social and ecosystem factors in a co-creative process

The first strategy underlies the nature-as-infrastructure solutions of Todd and Todd (1993) and Lyle (1994); the principles of ecological design as put forward by Yeang (1995) and van der Ryn and Cowan (2007); and the concept of biomimicry (Benyus 2002). The second approach is implemented through the process of regenerative/integrative design, hailed by Reed (2006) as the most comprehensive basis for rethinking the role of buildings as a catalyst that can positively support the co-evolution of human and natural systems. This is perhaps the first approach to bridge the physical, functional, emotional and spiritual attributes of nature and humans from a co-evolutionary perspective, rather than a managerial one (Charest, 2009). Regenerative design and development shares the commitment to systems thinking and partnering with nature as advocated by the new paradigm.

A number of key issues emerge from a shift in paradigm that have both direct and indirect consequences for transforming the behaviour of current stakeholders to support and engage in sustainable design and construction practices, as well as extending the range of positions represented in decision-making. The paper now focuses on the following three issues as a means of informing and framing such a discussion:

- creating effective change in a complex system
- redefining stakeholders and their roles
- assessing sustainability in the built environment.

How to create effective change in a complex system

According to Meadows (1999), change within a system can most effectively be made through intervention at specific leverage points. She identified a number of places to intervene, which may affect the whole system. The least effective place is to change parameters or numbers (e.g. quality or performance standards, numerical targets). In increasing order of effectiveness they are: the rate and structure of material flows and nodes of material intersections; the strength of negative and positive feedback loops; the structure of information flows; the rules of the system (incentives, punishments, constraints) and changing the goals of the system. However, the most effective leverage point in a system, she suggests, sits at the mindset or paradigm out of which the system arises and the power to transcend paradigms.

But what are the leverage points or places to intervene in a system such as the built environment? Within Meadows's characterization, current interventions such as rating and assessment systems, regulations and incentives operate at the lower range of effectiveness. To be more effective it is necessary to aim interventions at leverage points in the goals and the mindset or paradigms that inform the system. Jaime Lerner, architect and former Mayor of Curitiba, Brazil, developed the concept of 'urban acupuncture', according to which pinpointed interventions in strategic places would release energy and spread positive effects in the whole urban system (Landry, 2005). These can be spatial points (pedestrianization of the inner city), points within the goals of the system (shifting from supporting individual car-based transportation to establishing a rapid bus transit system), or within the mindset and values of the system (assigning an economic value to waste). In describing a 'process of changing' Lerner suggests that:

> to make a change, in a city – or in a state, or anywhere – you have to have political will, solidaristic view and an equation of co-responsibility .And when you have an equation of co-responsibility, when people understand the ideas, everyone, they know how to share it [1].

In other words, change the mindset and the required change in attitude will follow. Curitiba's success, Lerner emphasizes, derives from simplicity:

> We never tried to have all the answers because if you try to have all the answers, its…. not leaving for the next generations everyone [sic] to make their contributions, and synergy.[2]

Implicit within this process is the acceptance of uncertainty discussed above.It is crucial to understand that the outcome of intervention at a specific acupuncture point cannot be fully controlled or even predicted. Meadows offers the strategic direction that while complex systems cannot be controlled, 'they can be designed and redesigned' and that:

> we can't surge forward with certainty into a world of no surprises, but we can expect surprises and learn from them and even profit from them (Meadows, 2002, p. 2).

In terms of stakeholder interrelationships, merging the notions of system and uncertainty would suggest that:

> it is necessary to move from being 'experts' to being 'co-learners' [and that] the basis of a systems approach is the establishment of a network of mutual learning (Reed, 2005, p. 26).

In this way, the mindset from which decisions are made by the various stakeholders is changed from one of prescriptive and fixed control mechanisms to a reflective process that is anticipatory, responsive and flexible. A shift in perception to a level that embraces interdependencies, complexity and non-linearity, coupled with the experience of co-learning and being co-creators of the built environment would also necessitate a rethinking about who the stakeholders are and what their roles would be.

Stakeholders and their roles

Stakeholder engagement in a new sustainability paradigm requires a number of shifts. Firstly, it is necessary to redefine stakeholders in design and construction in a way that moves beyond the traditional triad of built environment professionals, developers/clients and government regulators as those responsible for creating the built environment, and the 'community' as an interested/affected stakeholder. Secondly, the various roles of these stakeholders need to be reinterpreted. Thirdly, it is necessary to rethink how best to engage with these stakeholders in a way that brings about change at the paradigmatic and value system levels of the system.

Redefining stakeholders and their roles

Mitchell et al. (1997) describe two categories of stakeholders:

- *Direct*, normative or instrumental stakeholders: those who carry a risk if the company's wellbeing is compromised and who can affect the achievement of an organization's objectives.
- *Indirec*t stakeholders: those who are affected by and therefore at risk because of the activities of this company/actor, but often have little power to affect the achievement of the company's objectives.

In traditional stakeholder theory (as explained by Mitchell et al., 1997), what is at stake is the wellbeing (reputation, profit) of a company (or other actor such as a government entity). However, defining stakeholders in the context of built environment sustainability is less clear-cut.

Chiniyo and Olomolaiye (2010) provide an extensive discussion of stakeholders in construction, including environmental stakeholders such as non-governmental organizations and community-based organizations. Whereas there are corporate stakeholders (as described above) for the various entities that constitute the construction industry, as well as for entities like local governments and the project clients, the term 'stakeholder' as used in the built environment mainly refers to project stakeholders. Cleland (1998, p. 55, cited in Winch, 2007, p. 273) defines project stakeholders as "people or groups that have, or believe they have, legitimate claims against the substantive aspects of the project".

These can be primary (or internal) stakeholders who have a contractual relationship with the project or another internal stakeholder of the project, and therefore an enforceable claim; and secondary (or external) stakeholders that have no direct power or claims that are only enforceable through legal or political action (Winch, 2007, p. 273). Usually the internal stakeholders are in favour of a project, as they will profit from it, while the external stakeholders can also be neutral or against the project. In a sustainability paradigm that recognizes the fundamental interdependence of the socio-techno-ecological system that is the built environment, this potentially oppositional stance has become obsolete. That which is at stake is far more than the profitability or reputation of the actors involved in a construction project – it is also the well-being of the social–ecological systems within which the project is situated, as well as the well-being of future generations (a fundamental tenet of sustainability).These two entities – the social–ecological system and future generations – therefore also have a stake in the project. However, in this new worldview there is no clear dividing line anymore between internal and external stakeholders, as internal stakeholders are also part of the global and local social–ecological system within which they operate and therefore have a vested interest in its well-being. Most individual actors in the construction industry also have a vested interest in the well-being of future generations through their own progeny.

The amorphous nature of these two entities – social– ecological systems and future generations – makes it difficult to see them as stakeholders in the traditional sense. They are currently perceived as having no voice, power or influence, and as having no capacity to act. But this is not necessarily the case within a social–ecological system. Given the feedback loops between human activity and the ability of the natural environment to provide the vital ecosystem services that support this activity, Nature can no longer be seen as merely a passive victim of 'impact' with no agency. Viewing building construction as something that simply 'happens' to what are often seen as powerless affected secondary stakeholders, fails to grasp the fact that they are equally powerful co-creating stakeholders in the construction of the built environment.

There has been extensive debate about the explicit inclusion or representation of the 'environment' or 'Nature' as a stakeholder in strategic decision-making (e.g. Fineman and Clarke, 1996; Orts and Strudler, 2002; Driscoll and Starik, 2004) Similarly, the fields of ecology, natural resource management and others have revived the notion of a closely coupled relationship between humans and Nature, giving rise to the concept of social–ecological systems. Anderies et al. (2006) describe social–ecological systems as integrated living systems consisting of agents (human or otherwise), their actions and behavioural patterns, and 'a physical substrate (chemicals, energy, water)'. All of these agents can be considered stakeholders in the actions of all other agents in the social–ecological system, as suggested by Starik (1993), who defines a stakeholder as any naturally occurring entity that affects or is affected by organizational performance and, by including all living organisms (also animals and plants), as well as landscape elements (rocks, water) and the cosmos in general, extends the definition of stakeholders far beyond currently acknowledged limits.

While Nature, of course, cannot be anthropomorphized as a stakeholder with cognitive abilities, the various components of the biosphere act according to the logic of natural laws in response to the actions of human/societal stakeholders to affect the outcome of a project. Thus, Nature is made an active participant in ensuring the success of a project. This shift in perspective introduces the idea of Nature as 'primordial and primary stakeholder' (Driscoll and Starik, 2004, p. 69). That Nature is also an actor with the ability to affect the objectives of an organization and therefore a direct instrumental stakeholder is a profound conceptual shift in the collective understanding of what constitutes a stakeholder.

It can be argued that the natural environment, through intermediaries like non-governmental or community based organizations, already has a strong political and economic voice. The efforts of thinkers like Amory and Hunter Lovins and Paul Hawken (Hawken, 1993; Hawken et al., 1999) have created not only awareness within industry that environmental sustainability and economy are closely interrelated, but also how working with nature can have positive economic results.

Since climate change and diminishing natural resources are affecting the world's economy, and since both affect society in numerous direct and indirect ways, their mutual interdependence has now become explicit. This, in turn, is urging the establishment of new business models that accept the natural environment as a crucial business partner (also World Resources Forum (WRF), 2009) and an erosion of the traditional boundaries between instrumental primary stakeholders and interested/affected secondary stakeholders such as the natural environment, local communities and even individuals in these communities.

Through the lens of this whole/living systems paradigm, not only does Nature become visible as an active participant in the creation of the built environment, but the active role of communities also comes to the fore. Urbanization is not driven by governments or developers, but by choices and actions of individuals who, in many parts of the world, are often poor and marginalized (du Plessis and Wallbaum, 2010, p. 357). While the natural environment provides the parameters within which design decisions are situated and construction happens, it is the individual choices of citizens that ultimately dictate the form and functioning of the built environment. In this sense there are no real 'external' or secondary stakeholders in sustainable construction, as society and Nature participate in the creation of the built environment, and the traditional internal stakeholders of construction projects are also affected as individuals by the negative (or positive) impacts of the project.

Expanding the definition of stakeholder to include the natural environment as partner in the creation of the built environment, and acknowledging that the internal stakeholders are also affected stakeholders, introduces a new power dynamic and new roles, such as the provision of physical (not just financial) resources, additional economic value, and new strategies (e.g. regeneration), as well as a means for the application of political or civic pressure.

Changing the ways stakeholders are engaged

Stakeholders in building and construction are becoming more aware of the need to embrace sustainability, as evidenced by the rapid establishment of Green Building Councils across the world (World Green Building Council (WGBC), 2010). However, the complexity of the construction sector, and the even greater complexity of the social–ecological system within which it operates, limits the effect of currently framed policies, regulations, labelling schemes, subsidies or preferential financing mechanisms put forward as incentives to change. By continuing to offer simple linear solutions to complex problems, current mainstream sustainable construction practices and incentives often lead to good intentions having unintended consequences and driving perverse behaviour (Shendler and Udall, 2005; Birkeland, 2008).

The forgoing sections raise a host of new questions including: How does one deal with diverging interests*, e.g.* diverging priorities in the field of sustainability? How can cooperation of all stakeholders as equal partners be achieved, considering that not all partners have equal stakes in the built environment or equal abilities to engage? What kind of policies and incentives would be required? To begin addressing these questions, it has become necessary to re-invent not only the practices of decision-making, but also perhaps the very assumptions and values on which decisions are based in the design, construction and operation of the built environment so as to include the interests of the silent stakeholders (*i.e.* Nature, future generations and the poor and marginalized).

Cooperation and new ways of making decisions

In spite of the existing conflicts of interests among different stakeholders, the construction sector is gradually advancing towards the development of new forms of interaction among actors, although these ”dynamics are not [yet] sufficient to break down the numerous institutional barriers which contribute to professional identities, to decision making and to the organisation of everyday life” (Henry and Paris, 2009, p. 171).

There are more and more initiatives that aim at getting all traditional stakeholders in the production of the built environment to cooperate, as, for example, the UNEP Sustainable Buildings & Climate Initiative (SBCI). This initiative strives for a cross-sectional, multi-stakeholder consensus, which aims at the provision of a platform shared by all relevant building and construction stakeholders to address sustainability issues, such as climate change, at the global level (UNEP SBCI, 2009, p. 7). Such a platform might show the ability to advance the collaborative development and implementation of tools and strategies, as well as the establishment of guidelines. Key success factors then are the personal commitment of key stakeholders and the promotion of tools and strategies within their networks. This approach assumes that if actors are all treated as equal partners, a vision of potential actions and solutions based on common interests can be developed (Cordano et al., 2004, p. 37; Onkila, 2009, p. 294).

As an even more radical change to decision-making in the design and construction of the built environment, Reed (2006, pp. 677–678) suggests the idea of regenerative design as offering:

> a conscious process of learning and participation through action, reflection and dialogue that engages . . . all the key stakeholders and processes of the place – humans, other biotic systems, earth systems, and the consciousness that connects them – [to build] the capability of people and the ‘more than human’ participants to engage in continuous and healthy relationship through co-evolution.

The non-human systems are engaged through understanding the ‘Story of Place’ and asking what the aspirations of nature would be in that place (Reed, 2007). These aspirations are then put on the table when discussing the human stakeholders’ aspirations and win–win solutions are sought based on common values. This approach has fundamental implications not only for the processes of decision-making, but also for the values that underlie the choices made.

A shift in values

The rate and extent of the adoption of sustainable construction practices, as well as the inclusion of a broader range of stakeholders into the process, is highly dependent on specific cultural preconditions. A shift in values towards the sustainability paradigm is a necessary initial step to change and align these preconditions, one that will require a deeper understanding of business–nature relationships (Onkila, 2009, p. 287). Lazlo (2009, p. 45) suggests that it is necessary first to forget the values that underlie current self-centred, consumerist and power-hungry lifestyles before it is possible to move to a planetary ethic. Leiserowitz et al. (2004, p. 1) describe values as:

> defining or directing us to goals, frame our attitudes, and provide standards against which the behaviour of individuals and societies can be judged.

They suggest that values necessary for achieving sustainable development such as solidarity, equity, tolerance, shared responsibility and a respect for nature are already in place, but that it is the gap between attitude and behaviour that needs to be bridged. However, they conclude that the existing values will need significant change if the transition to another paradigm is to be achieved, and that further research needs to be done to determine what value changes will be required to achieve such a transition.

Du Plessis (2009b, p. 226) proposes that the values that will form the basis of sustainable construction practices will be founded on an understanding of:

- an interconnected, interdependent and integrated (whole) world and, with that, the non-duality of self and non-self, with the Other instead seen as an extension of the self, leading to the values of mutuality, positive reciprocity, inclusivity, integrity, harmony and respect
- the importance of relationships and the idea that the world is co-created through those relationships, leading to the values of fellowship and responsibility, and
- the world as constantly changing, inherently unpredictable and ultimately impermanent, leading to the values of caution, humility and non-attachment

Questions such as how this shift of values can take place in different cultural settings begin to assume considerable importance and will invariably involve reciprocal knowledge transfer between scientific and professional disciplines and other sources of knowledge.

Finding an appropriate mix of policies, incentives and other instruments

While the new paradigm is the driver of change in the system, incentives and policy instruments, when introduced at appropriate leverage points, can initiate changes that could lead to sustainable actions within the system. Reinventing stakeholder incentives requires a more complete understanding of the system within which incentives are to be introduced and the key leverage points where effective change could be achieved, as well as understanding how to engage with complex systems. A shift in paradigm will change the goals and rules of the system (e.g. policy instruments), the flows and feedbacks within the system (e.g. incentives and disincentives), and eventually the standards and parameters (e.g. indicators) used to assess progress and performance. Unpacking what the whole/living systems paradigm would require at each level would be a formidable task. This paper looks at one aspect, namely sustainable construction assessment systems and how a shift in paradigm would affect these systems.

Implications for assessing sustainable construction

Currently sustainable construction is driven by two main tools: policy and regulatory instruments and voluntary or regulated assessment and rating programmes. These assessment/rating programmes can be found at all scales of the built environment, from cities to materials and appliances. The following discussion focuses on tools, methods, and systems used at urban and building scales under the general descriptor of sustainable construction.

Assessment implies measuring how well or poorly something is performing, or is likely to perform, against a declared set of criteria. The term ‘assessment tool’ is often used generically to describe techniques that have been crafted to assist in accomplishing a specific performance or intention. In building design and construction it is used to describe a technique that predicts, calculates or estimates one or more environmental performance characteristics of a product or building, e.g. operating energy use, greenhouse gas emissions or embodied energy. The term ‘assessment method’ describes a technique that has assessment as one of its core functions, but may be accompanied by third-party verification before issuing a performance rating or label, include reference to or use of a number of tools, and may offer supporting educational programmes for design professionals (Cole, 2005a).

Building environmental assessment methods were initially conceived, and still largely function, as voluntary, market-place mechanisms by which owners striving for improved performance would have a credible and objective basis for communicating their efforts. Within this context, ensuring that the methods were simple, practical and inexpensive in both their use and maintenance was deemed paramount. This remains the case. Assessment systems at larger scales tend to be driven by legislation (e.g. environmental impact assessment) or by the strategic planning needs of local governments.

Both these types of tools require regular participation by and input from the various stakeholders. Indeed, Kaatz et al. (2006, p. 317) suggest that:

> future evolution of building assessment will most likely be geared towards the enhancement of the building process and the empowerment of stakeholders through their direct experience in sustainability- oriented decision-making.

These critically important notions, they indicate, will require placing equal, if not greater, emphasis on the quality of social processes than on the development of technical competence. Furthermore as Reed (2006) points out, a regenerative design process requires understanding of and engaging in the unique qualities of the ‘place’ where projects are situated. This stands in contrast to current building environmental assessment methods which have struggled to recognize and accommodate regional distinctions.

The notion of assessment is also closely related to analysis and valuation, which is mainly intended to achieve prediction and control. The contradiction is therefore raised: one cannot predict and control a complex system as one predicts and controls a machine. One of the main barriers to overcome in the process of shifting the paradigm that informs interventions in complex systems is the notion that it is possible to predict and control the processes of growth and evolution in the natural and the built environment. Furthermore, all assessment tools and methods strive to provide an accurate characterization of performance, *i.e*. they strive to provide greater certainty in understanding how a building will perform over its life. Moreover, all assessment tools and methods simplify the context and the processes of the systems that they are attempting to evaluate, which results in reductionist tools and methods. However, inherent in the simplification is the assumption that both nature and human nature are measurable, predictable, controllable and replicable factors. The whole/living systems paradigm challenges both this assumption and the reductionist approach by arguing for an acceptance of uncertainty and a whole systems approach to assessment.

Accepting uncertainty

Complex systems, be they corporations, cities, buildings or ecosystems, are ever-changing and continually being reconstructed. If change and uncertainty are, according to the notion of complex systems, the only certainty one may have, then it is clearly necessary to make this much more explicit in strategic building design decisions and the tools used to assess their success. In order to assess sustainable construction, therefore, it is necessary to consider the dynamics of complex systems and the values that inform them. Systems theory may function as a tool to assess sustainability, but this will require a new approach of problem analysis and interpretation. It requires a multidimensional perspective and the identification of patterns within and among various systems and subsystems. Such characteristics are not evident in current assessment tools and methods, and are not easily overlaid upon them. New approaches would have to recognize that the processes and products of construction are part of and in themselves complex adaptive systems subject to what Rittel and Webber (1973) term 'wicked problems'. These are problems that are not clearly delineated, and for which there are neither clear indicators to indicate when they have been solved, nor one set of permissible solutions. In addition, possible solutions are value-based (good, bad), not truth-based (true, false) and there is no way of fully appreciating the possible consequences of a solution.

Assessment systems capable of dealing with change and uncertainty require the development of tools that focus on understanding the systemic interactions and consequences (feedbacks) of the project being evaluated at a number of scales, including the global, and allow for iterative processes of doing, reflection, learning and adaptation (du Plessis, 2009b, p. 317). Instead of assessing performance against a set of indicators corresponding to predetermined sustainability criteria such as energy efficiency, urban assessment systems will be concerned with monitoring the resilience and adaptive capacity of the social–ecological system and building assessment systems will focus on the building's contribution to the resilience of the larger system. Dealing with the demands of complex systems requires whole systems thinking and assessment systems that reflect such thinking.

Assessing whole systems performance

Most current assessment methods are based on aggregate indicator sets of permissible or required actions and/or components within sub-problems that can easily be reduced to quantitative measures such as ratios of energy use or carbon emissions per square metre, or bicycle racks per number of tenants. These methods are criticized for not fostering integrative design using whole-systems synergies (Shendler and Udall, 2005; Birkeland, 2007). For this reason critiques of current sustainability assessment and evaluation methods (e.g. Bossel, 1998; Cole, 2005b; Birkeland, 2005; Brandon and Lombardi, 2005) call for 'holistic' assessment and evaluation approaches that would integrate all related impacts, take into account multiple viewpoints and objectives, and address the significant linkages in the system, including ecological, technical and institutional systems (du Plessis, 2009b, p. 9).

The past decade has witnessed several developments that suggest a gradual evolution toward a more comprehensive framing of performance, and as such it is reasonable to argue that a number of the traits of a new sustainability paradigm are slowly emerging in both the theory and practice of green building design and in the development of assessment methods. These developments include:

- an increase in the number of performance criteria deemed necessary to characterize a ‘green’ building
- an increasingly seamless discussion between building and community-scale assessment and
- an increasing adoption of an integrative approach to design whereby an expanded consulting team is engaged concurrently at the outset of a project.

Conclusions

While improvements in sustainable building design and construction practice can be made within existing norms and conventions, this paper has argued that the necessary significant and lasting gains will not be achieved without a consistent, overarching shift in the way that things are currently framed. Such a reframing should be premised on establishing and maintaining a symbiotic and regenerative relationship between human society and the social–ecological systems within which it is embedded. While the idea of the need for a new paradigm is certainly not new and has been emphasized in many disciplines, its consequences for the stakeholders in building design and construction have hitherto been relatively unexplored. Three major shifts in thinking that influence the model of sustainability in a whole/living systems paradigm have been identified in this paper: from complicated to complex systems, from an equilibrium to a non-equilibrium model, and from an anthropocentric to an ecocentric worldview. This leads to a view of sustainability that moves beyond a simplistic model of achieving balance between economy, society and environment to a model based on resilience and adaptive capacity and a co-evolutionary partnership between humans and the natural environment of which they form part that is aimed at the regeneration of social–ecological systems.

While the rationale and characteristics of a new paradigm can be easily presented and understood, the ways and extent that it can supplant the prevailing paradigm needs urgent intellectual and practical interrogation. This paper has argued that the implications of this paradigm for the debate on stakeholder engagement are three-fold. Firstly, a systems view suggests that the most effective change will happen through changing the mindset and values of stakeholders. Only when change has happened at this level would it be possible for tools founded on complex adaptive systems to be fully effective in shaping design and practice. Secondly, it calls for a redefining of who qualifies as stakeholders and their roles. By understanding the interconnected and interdependent nature of social–ecological systems, the clear divisions between internal and external stakeholders are blurred. Actors who are part of the construction team in a project would be both internal and external (i.e. affected) stakeholders, while traditionally external and powerless stakeholders such as local communities and Nature are recognized as playing a major role in the creation and functioning of the built environment. Thirdly, the new paradigm changes the practices of stakeholder engagement through including the stories and aspirations of place (as proposed by Reed, 2007), suggesting a different value set on which to base decisions, and introducing a cascading set of changes in the rules and goals of the system (e.g. policies), the flows and feedbacks (through incentives and disincentives) and eventually the tools such as assessment systems and their indicators.

While accommodating the primary characteristics of complex systems and defining exactly the changes that need to be resolved remains a distant objective, some directions can be postulated. It is suggested that the future design and role of rating systems would, by necessity, require the acceptance of uncertainty (and therefore a move towards assessing resilience and adaptive capacity) and a whole systems approach. Rather than striving solely for an understanding of an individual building's performance, the potential contribution it makes to the social, ecological and economic health of the place it functions in will be of equal, if not more, significance. Moreover, by accepting that the building is an ongoing, dynamic process within an ever-changing environment, the value of a static tool like a rating system as an indicator of sustainability performance needs to be questioned.

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