THE 'INVISIBLE HANDS' OF ECO-SYSTEMS HYBRIDS IN MEDIATING SUSTAINABILITY DISCOURSE

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ABSTRACT

Within parts of sustainability policy arenas and the accounting literature, there is a faith in the self-organising properties of eco-systems and nature. This is translated into laissez-faire solutions that require no human governance, since nature has her own 'invisible hand' to rectify the follies of humanity. However, such conceptions of self-governance may represent little more than an equation within an abstract mathematical model, rather than behaviour based on observable phenomena. In this paper, we explore the impact of the nature and scientific origins of self-organising 'eco-systems' and their possible consequences for developing sustainable accounting. We consider the appropriateness of different eco-system hybrids as mediating instruments in the emergence of sustainability programmatic discourses and in changing local processes and practices. Our initial evaluatory framework makes visible some of the implicit assumptions with eco-systems. There is considerable diversity in the eco-system hybrids present in sustainability programmatic discourses, and the selection of any given eco-system hybrid as a mediating instrument can result in substantively different problematisations and solution templates. Understanding eco-system behaviour, and in particular understanding appropriate feedback mechanisms, is useful for sustainable accounting processes and practices. Eco-systems thinking can help identify appropriate sustainable entities, sustainable dynamics, different concepts of predicting behaviours and modelling social, ecological and power distribution consequences, appropriate regulatory mechanisms and the role of human agency. All of the above issues are central to the emergence of sustainable accounting and sustainable societies, but only if the underlying eco-systems are representative of ecological and social realities.

"The idea of proper change, or really shifting things, is alien to us today. We just argue about how best to manage a system. It's a moment of high decadence. We've forgotten that we do have deep responsibilities to people who really are powerless. Democracy needs proper politics, but people have given up on saying that they're going to change the world."

<div align="right">Adam Curtis (quoted in Viner, 2011)</div>

1. INTRODUCTION

Eco-systems have played, and are likely to play, a powerful role as mediating instruments to translate programmatic sustainability discourses into local settings and to construct hybrid governing processes and practices such as sustainable accounting (Miller et al., 2008; Wise, 1988). In this paper, we explore the appropriateness of different eco-system hybrids in translating or framing sustainability programmatic discourses into local processes and practices, and the possibility of eco-systems capturing and distorting the sustainability discourse. We are concerned that the diversity of eco-system hybrids is not fully reflected within programmatic sustainability arenas and sustainable mediating instruments. Furthermore, certain eco-system hybrids may be legitimated as mediating instruments, not because of their alignment with the sustainability programmatic discourse, but because of their resonance with other competing programmatic discourses such as neo-conservatism or globalisation (Gray, 2010; Oels, 2005; Curtis, 2011; Everett & Neu, 2000; Hajer, 1997; Latour, 1998; Luke, 1999).

We conceptualise eco-systems as hybrid objects that were formed and reformed at the margins of a diverse range of scientific disciplines, where commonalities existed at the intersections in these disciplines. Hybridisation is a reflexive process that involves at least two separate objects or ideas combining in a local setting to form a new hybrid object (Kurunmäki and Miller, 2006; Miller et al., 2008). However, this new object also affects the objects and context from which it emerged. In this paper, we explore the hybridisation routes of six eco-system hybrids: *Gaia* (Lovelock, 2000; Ward, 1966), *Club of Rome* (Forrester, 1971; Meadows et al., 1972), *Selfish Gene* (Dawkins, 1989), *Traditional Ecology* (Odum, 1994), *New Ecology* (Haila & Dyke, 2006), and *Deep Green* (Naess, 1989; Carson, 1962; Zimmerman, 1994). These six archetypes were selected because of their recognisability and influence in the programmatic sustainability discourses that we seek to evaluate in this paper, both as sustainability mediating instruments in general and from the perspective of sustainability accounting in particular.

For the purposes of this paper, we differentiate between two sustainability discourse arenas: the political and the scientific. These programmatic discourses are connected, but not in a simple linear fashion. Rather, they are dynamic and reflexive, continually being formed and reformed from the intersections between different scientific disciplines and other social and political programmatic discourses. We characterise sustainability as a novel and fragile discourse that lacks the robustness and power of other contemporary programmatic narratives. The sustainability programmatic discourses are complex, multi-faceted and problem-based (Robinson, 2008), and have also been described as issue-based interdisciplinary discourses (Bebbington & Larrinaga, 2011; Frame & O'Connor, 2010; Functowicz & Ravetz, 1993; Kastenhofer et al., 2011; Pretty, 2011). Sustainability emerged from attempts to locate environmental problems, normally mediated through scientific findings, in social, political and economic systems. Sustainability is a hybrid discourse constructed from multiple knowledge realms and that can be contrasted with narrower, abstract, ideological programmatic discourses, such as capitalism, individual freedom, security and advanced

liberalism (Beck, 1992; Beck & Wilms, 2004; Dean, 1999, 2007; Gray, 2010). The problem-based focus of sustainability means it is less stable and more dependant on changes in other disciplines, mediating instruments and programmatic discourses. Mediating instruments are therefore more likely to be constitutive in problem-based programmatic discourses such as sustainability (and accounting; see, for example, Kurunmäki et al., 2006; Miller et al., 2008).

Unsustainable development is often framed, politically and scientifically, as a risk to all (Bebbington & Thomson, 2007) and is considered impossible to solve using single disciplinary processes, practices and expertise (Bailey, 2002; Carpenter & Bishop, 2009; Frame & O'Connor 2010; Quental et al., 2011; Robinson, 2008). Unsustainability requires disciplinary and organisational boundary spanning processes, practices and expertise, to mitigate its undesirable consequences (Bebbington & Larrinaga, 2011; Frame and O'Connor, 2010). Unsustainability also requires urgent and novel solutions due to the severity of its potential hazards, complex interdependencies, incomplete and contradictory evidence-based and competing epistemological positions. Developing sustainably transcends individual corporations, public service, third sector and government entities and individual disciplines' processes, practices and expertise. We characterise sustainability as a boundary spanning programmatic discourse, albeit a relatively unstable hybrid, that seeks to provide solutions to the fears and uncertainty of potential ecological destruction and social disorder. We are also concerned about the role that ecosystem hybrids play in constructing these risks and fears and their use as 'blueprints' for solving these risks and fears (Bailey, 2002; Beck, 1992; Power, 2004; Meadows et al., 1972; SDC, 2007; Hawken et al., 1999).

Our initial interest in this topic came from an unexpected source: a recent BBC television documentary series entitled *All Watched Over By Machines Of Loving Grace* (Curtis, 2011). In this series of three films, writer and director Adam Curtis explores his theory that contemporary society has been colonised by computers, and that computers, computer models and computer networks are invisibly reconstructing our notion of what the world is and what the world could become. Our particular interest in this paper was sparked by the second episode in the series, entitled *The Use and Abuse of Vegetational Concepts*. The programme examines the influence of cybernetic systems concepts in the development of notions of eco-systems and self-organising networks. Curtis's argument is that the popular idea of nature as a self-regulating eco-system and the 'balance of nature' is a computer fantasy. This computerised model of nature does not reflect the complexity of nature or contemporary ecological theories and empirical evidence (Haila & Dyke, 2006; Waldrop, 1992; Naess, 1989; Scheffer et al., 2001). The self-regulating, self-balancing eco-system that emerged in the 1950s did so at a time when cybernetic models were used to define the underlying structure of nature processes, and became foundational principles of the ecological science that dominated the 1960s and 1970s (Ackoff, 1960; Castellani & Hafferty, 2010; Forester, 1971; Odum, 1994; Weiner, 1961).

These cybernetic models of nature as eco-system were underpinned by a mechanical theory of order that considered humans, and everything else on the planet, as components in systems of interlocking feedback mechanisms (Forrester, 1971; Odum, 1994). It is argued that these eco-systems played a powerful mediating role between the continually evolving scientific and political sustainability discourses as well as playing a critical mediating role in the translation of the political programmatic discourse into local processes and practices. We speculate that the use of the eco-system as a mediating instrument obscures, and may leave unchallenged, any ideological or political dimensions in both the political and scientific sustainable programmatic arenas. The use of eco-systems, with its scientific heritage, could be

misinterpreted as a direct channel from the sustainability science discourse to local organisational processes, 'uncontaminated' by political sustainability programmatic discourse (Oels, 2005; Hajer, 1997).

We argue that an essential part of understanding the programmatic discourses associated with sustainability, and how they are operationalized, including via accounting, is to critically explore sustainable mediating instruments, particularly when there is a choice of instruments to use and how to use them. We are not arguing that eco-systems *per se* are problematic mediating instruments; on the contrary, we suggest it is impossible to disentangle eco-systems from sustainability programmatic discourse arenas. Nevertheless, the characteristics of specific eco-system hybrids, particularly their implied self-regulatory mechanisms (their 'invisible hands') and equilibrium assumptions, can cause widely divergent 'sustainable' local processes and practices with varying social and environmental consequences. However, given the complexity of governing any transition from our current unsustainable state, it is difficult to see how this could be 'automated' and powers devolved to mythical natural forces with no human agency, transparency or dialogue.

2. HYBRIDISATION

In our analysis of eco-systems, we draw on aspects of governmentality, and in particular, how programmatic discourse - the ideas and concepts associated with reform processes - are mediated, by becoming operable in local contexts and ultimately impacting on local processes and practices (Kurunmäki et al., 2006; Wise, 1998). Miller et al. (2008) define hybridisation as two or more discrete elements combining to create a new object which in turn forms part of an organisation's processes, practices and expertise to manage uncertainty. Hybridisation typically requires some form of commonality between the discrete elements to allow the hybrid object to emerge. We are concerned with the possibility that certain actors in sustainability discourse arenas may distort the intentions or motivations of reformers, and create or exploit gaps between the ideas of the reformers and the instruments that are supposed to make them work (Kurunmäki et al., 2006).

Any hybridisation of processes and practices is influenced by the extent, or fear, of risks and uncertainty to any specific organisation. A major source of that fear is the assemblage of programmatic discourses that surround that organisation and create new perceptions of the organisation's hazards (Beck, 1992, Beck & Wilms, 2004; Power, 2004; Miller et al., 2008) that are placed in contradiction to the immediate imperative for service delivery to its clients or customers. The greater the perceived fear of a catastrophe, the greater urgency for the hybridisation of new knowledge, practices and processes to render governable these risks and uncertainties. The resultant search for mediating instruments is further accentuated when the apparent source of the uncertainty lies beyond both organisational boundaries and the scope of existing forms of governing (Frame & O'Connor, 2010; Robinson, 2007; Allen et al., 2011), and in addition when these risks are themselves novel, unstable and do not possess local, routinised governing processes, practices or expertise.

In certain situations, there is the possibility that mediating instruments become conflated with, or reshape, wider programmatic discourses, rather than acting as a template for change in local settings. It is important to recognise that the dynamics of local practice are not driven by a coherent, universal programmatic discourse, but from the multiple, often competing, programmatic discourses that frame a particular institutional setting. Any reform in local processes and practices has to engage with a complex, contested set of expertises, processes

and practices and competing sets of mediating instruments (Van Helden et al., 2010), with the danger that both the programmatic discourse and local existential reality are problematically reconstituted. For example, sustainability accounting is more likely to be formed and reformed in local institutional settings by sustainable mediating instruments rather than the scientific or political sustainability programmatic discourses, particularly by mediating instruments that are aligned with existing accounting hybridised processes and practices (Gray, 2002; Russell & Thomson, 2009; Miller et al., 2008).

Hybridisation is said to occur when two or more elements 'rub against' each other, which presupposes that there is an established 'thing' for something to rub against. In the context of sustainability, novel risks, fear or uncertainties may emerge. In such circumstances, hybridisation may extend beyond local boundaries and the capabilities of an organisation to access or create novel forms of expertise, practices and processes. Appropriate sustainability hybrids will be influenced by the critical abilities of existing organisational networks to interpret and assimilate this new knowledge from these boundary spanning networks, particular when this new knowledge is pre-packaged in the form of a mediating instrument.

2.1. Systems, Science and Hybridised Sustainability Programmatic Discourse

Concerns have been raised that sustainability programmatic discourses could be captured or subverted in order to suppress different forms of knowledge and governing processes and practices considered necessary for any sustainable transformations (Oels, 2005; Gray, 2010; Russell & Thomson, 2009). These concerns are particularly relevant as we consider sustainability to be a relatively unstable hybridisation of many different expertises, practices and processes (see, for example, Frame & O'Connor, 2010; Gray 2010; Robinson, 2007). Sustainability discourses change, and are changed by, encounters with different programmatic discourses, expertises, mediating instruments and practices. Misalignments may also occur between mediating instruments and the sustainability programmatic discourse, which could lead to local 'sustainable' hybrid processes and practices that perpetuate or accelerate global catastrophes and worsening social order (see Gray, 2010 for a discussion on the problems of developing sustainability-accounting hybrids).

An illustration of the hybridisation of political and scientific programmatic discourses has been described by Oels (2005) in relation to climate change. Oels discussed two competing hybrid programmatic discourses associated with climate change, green governmentality and ecological modernity. The climate change scientific discourse was heavily influenced by the Gaia eco-system hybrid (Lovelock, 2000), which viewed the climate as a powerful self-regulatory feedback mechanism for the Earth. Both green governmentality and ecological modernity incorporated the above climate-related programmatic discourse, but differed in terms of their programmatic discourse on how to govern. Oels locates green governmentality as a hybrid discourse between biopower (Dean, 1999, 2007; Foucault, 1991; Luke, 1999) and science. Green governmentality reinforced the power of the state and legitimated government interventions based on scientific evidence and rationality (See also Beck, 1992; Beck and Wilms, 2004; Power, 2004). This created an environmental discourse where the climate, a critical part of our planetary eco-system, comprised of "spaces under police supervision, expert management or technocratic control" (Luke, 1999, p.194). Mediated through eco-systems thinking, climate change created a programmatic discourse concerned with international security requiring governmental interventions, often on a transnational scale, and the creation of regulatory structures to re-balance our climate system. Green governmentality necessitated the rational management by techno-scientific experts of natural

resource systems involving disciplinary measures such as prescribing normalised individual behaviour via environmentally friendly behavioural norms and extensive scientific policing of social and biological systems to establish order and security (Oels, 2005).

The sustainability discourse associated with ecological modernity was radically different from green governmentality (Dryzek, 1997; Hajer, 1997; Luke, 1999.) Ecological modernity could be viewed as a hybrid of a Gaian self-regulating climate system with the self-regulating market and governance mechanisms of advanced liberalism (Deans, 2007). Ecological modernity challenged the green governmentality discourse, and blamed the policing of the environment by state institutions for creating the environmental crisis. The ecological modernity discourse dictated that governments should cease setting norms and policing the environment and 'free' the dynamics of these two self-correcting systems to operate synergistically to re-establish climate balance and order. This provided the theoretical justification for a programme of deregulation and extension of the logic of the free market, and the power of the market's 'invisible hand', to solve the climate change crisis (Oels, 2005). Consequently, governments' role should be restricted to creating economic incentives and empowering the free-market to facilitate the necessary technological innovation and social change. Ecological modernisation reconceptualised climate chaos as an opportunity for the reinvention of capitalist system (Hajer, 1997). Ecological modernity can be seen to have been aligned with other social and political programmatic discourses, and has come to dominate the political sustainability discourse and its mediation in local processes and practices. However, ecological modernity has not dominated the sustainability scientific discourse and scientific processes and practices to the same extent (Baumgartner, 2011; Pretty, 2011).

We suggest that the use of different eco-system hybrids as mediating instruments between science and political and between political and local change requires further investigation. This investigation may be motivated by the possibility of a decoupling between the programmatic discourse emerging from scientific communities researching sustainable problems and the sustainability political programmatic discourse. This decoupling is likely to arise from the use of inappropriate mediating instruments and the complex interaction of other political programmatic discourses. We suggest that there are certain characteristics of eco-systems that make them more likely to be used - and abused - as sustainability mediating instruments.

3. ECO-SYSTEMS AND SUSTAINABILITY MEDIATING INSTRUMENTS

Eco-systems, and systems in general, are hybridised objects and hybridising technologies (Ackoff, 1960; Waldrop, 1992; Castellani & Hafferty, 2010). Systems thinking involves explicitly searching for commonalities and relationships between discrete elements and integrating them into a coherent entity. It seeks to integrate and synthesise, and as a discipline it is located at the boundary and intersections of many other disciplines and it is also a constitutive science in that it 'creates' new boundary spanning disciplines (Castellani & Hafferty, 2010; Funtowicz & Ravetz, 1993; Gleick, 1987; Waldrop, 1992). System concepts and attributes become fertile channels and points of commonality for cross and interdisciplinary mediation. Certain attributes of systems thinking, such as self-regulation, equilibrium seeking, stability, order and feedback transcend individual knowledge domains and become points of potential hybridisation. Curtis (2011) develops his critique based on the commonality of these attributes between different global programmatic discourses and their synthesis into a problematic, oppressive governing ideology. It is this globalising, ideological

synthesis, with its emergent properties, that is problematic rather than its constituent sub-systems.

However, it is problematic to over-simplify the relationship between ecological science and systems science. It is not the case that systems theory developed independently of 'ecology' and was applied to help make sense of ecology. Rather, ecology and other studies of natural processes (including humans) were constitutive in the development of systems theories, and systems theories were similarly constitutive to the development of ecological science. This complex co-evolutionary relationship between systems and natural sciences is also interdisciplinary. For example, we may observe the impact and influence of other scientific discourses and disciplines such as biology, mathematics, economics, physics, sociology and psychology. Systems thinking has also been influential in the development of a wide range of other scientific disciplines, and is arguably an effective mediating instrument between different programmatic discourses. Systems science can also be seen to be an extremely broad church of ideas, that is extremely dynamic and creative and which continues to co-evolve and hybridise (Castellani & Hafferty, 2010).

What is common to all of these hybrids is that they were formed and reformed at the intersections of a wide range of different disciplines rather than from a single discipline. Eco-systems are not a simple hybrid between ecology and systems theory, but rather are formed from a complex set of interactions of inter-disciplinary ideas, concepts and empirical evidence. The six eco-system hybrids draw upon a wide-range of ontological and epistemological assumptions and a bewildering range of scientific methodologies and methods. We suggest that important insights can be gained by investigating these 'routes' for the development of sustainable accounting, and by monitoring the future hybridisation paths of eco-system hybrids and scientific and political sustainability programmatic discourses. It is beyond the scope of this paper to fully document the complex hybridisation of six divergent eco-system hybrids, and we do not claim to do so. Rather, we draw on the work of others and offer a high level overview of the different routes and stops along the way that have led to the creation of these eco-system hybrids.

Table 1 represents an overview of the main hybridisation routes taken by the six main eco-system hybrids we identified within the sustainability political and scientific discourse arenas. We observe that the Gaia, Selfish Gene, Club of Rome and Traditional Ecology hybrids have been incorporated into the current legitimated political programmatic discourse, whereas the Deep Green and New Ecology hybrids are on the fringes of the political sustainable discourse (normally labelled ecological modernity). Balance of nature, self-regulation and natural order are central to most political sustainable discourse. However the scientific sustainability programmatic discourse, often referred to as sustainability science, is more diverse and contested (Haila & Dyke, 2006; Daly, 1996; Gladwin et al. 1995; Hajer, 1995; Latour, 1998; Pretty, 2011; Quental et al., 2011; SDC, 2011; Wilkinson & Pickett, 2009).

Eco-system hybrid	Constituent elements
Gaia	Space exploration, astro-meteorology, climate science, complex systems
Selfish Gene	Evolutionary theory, epidemiology, genetic science, complex systems
Club of Rome	Game theory, defence studies, computer science, neo-liberal economics, cybernetics, holism
Traditional Ecology	Freudian psychology, mathematical modelling, entropy, biology
New Ecology	Biodiversity, symbiosis
Deep Green	Naturalism, ethics, religion

Table 1: Disciplinary Heritage of Eco-systems hybrids

When interpreting Table 1, it would appear that often the only thing in common between these eco-system hybrids is the label 'eco-systems', since their disciplinary heritage is diverse, and even in conflict. It appears to us that it is the commonality of certain system characteristics allows them to be hybridised and incorporated into other programmatic discourses. We suggest that only the New Ecology hybrid actually captures the empirical observation of natural processes, which emphasises the messiness, lack of natural balance and chaotic nature of natural and social systems. By contrast, the entity assumption in Gaia tends to diminish sub-system messiness, as the focus of Gaia is not at a species or eco-trope level but instead looks for balance at a planetary level and allows disequilibrium at sub-system levels (Lovelock, 2000). Both the New Ecology and Deep Green hybrids challenge the self-regulation, sense of equilibrium and stability present in Gaia, Selfish Gene, Club of Rome and Traditional Ecology, which may be argued to be machine-line characteristics (or 'fantasies') (Curtis, 2011) that have little to do with society or nature.

In addition to exploring the heritage of these eco-system hybrids, we further analysed these hybrids by identifying a number of key attributes and assumptions that we consider important for informing the political and scientific sustainability programmatic discourse and the design and selection of appropriates mediating instruments. These attributes and assumptions are: the entity; system dynamics; system predictability; self-regulating mechanism (invisible hand); human agency; social equity; and power. This analysis is summarised in Table 2 below.

	Entity	*Dynamics*	*Predictability*	*Invisible hand*	*Human agency*	*Equity*	*Power*
Gaia	Earth	Self-balancing	Homeorhesis	Earth	Powerless	n/a	For planet
Club of Rome	Developed world	Self-correcting	Homeostasis	Markets	Individual rationality	Status quo	Maintain hierarchy
Selfish Gene	Gene	Path dependent	Chaotic	Natural selection	Powerless	n/a	DNA
Tradn Ecology	Eco-system	Self-correcting	Homeostasis	Energy equilibrium	Conservation	Status quo	Services for humans
New Ecology	Eco-tope	Path dependent	Complex	Natural selection	Stewardship	n/a	Inter-dependence
Deep Green	Earth	Symbiosis	Chaotic	Co-evolution	Stewardship	Inter-species	Holistic

Table 2: Attributes of eco-system hybrids

A particular concern motivating this paper is that the full implications of using particular eco-system hybrids to mediate between sustainability science and the sustainability programmatic discourse and to mediate between this programmatic discourse and local processes and practices are not fully understood. Table 2 illustrates that all of the eco-system hybrids have little concern with social equity, have limited roles for human agency and problematic assumptions of power distributions. These assumptions may be legitimate within scientific disciplines where they form part of that disciplinary programmatic discourse, but are problematic when these eco-system hybrids are used to mediate and hybridise with other disciplines or programmatic discourse. As mentioned earlier, once these mediating instruments have been incorporated into wider programmatic discourses they can become decoupled from the scientific discourses, processes and practices from whence they came.

The four eco-system hybrids that predominate in the sustainability political programmatic discourse (Gaia, Selfish Gene, Club of Rome and Traditional Ecology) are the most 'scientific' in terms of the popular notion of 'big science' (space exploration, genetics, computer modelling, simulations, mathematics) and share underlying assumptions of a desire for natural balance, order and minimal human agency. The New Ecology hybrid does not separate humans and social systems from nature, while the Deep Green eco-system does seek to diminish the role of humans and to make them subject to the laws of nature. In Deep Green eco-systems, the laws of nature are generally considered to be unpredictable, unknowable and ungovernable by humans. In the other eco-system hybrids, there is an implicit assumption that these laws of nature can be uncovered, understood and made governable by humans, even if they are more concerned with what humans should not be doing.

Curtis (2011) suggested that dominant notions of eco-systems (Gaia, Selfish Gene, Club of Rome and Traditional Ecology) do not re-engage or co-evolve with their 'original' disciplines once they are captured in political programmatic discourses, despite their developments in their originating scientific disciplines or the scientific sustainability programmatic discourse. This is consistent with Miller et al. (2008), who suggest that it is only when a new crisis or risk is faced that changes to the programmatic discourse will be legitimated. A recurring theme of the documentaries produced by Adam Curtis is that since the 1960s, different crises (social, economic and environmental) have tended to leave the programmatic discourses relatively untouched, and if anything, have led to a 'more of the same' discourse. This has led to the development of more extreme versions of self-regulating, self-governing systems designed to establish social order and natural balance. In a recent interview (Viner, 2011), Curtis argues that despite both the recent collapse in the global financial system and government attempts to intervene to deal with these consequences, the belief that the financial system should continue to be self-regulated still dominates the programmatic discourse. Once these temporary problems are resolved, the state should back off and return the financial market to its rightful place in the free market. Likewise, the 'blame' for the crisis has been placed by many at the doorstep of government and regulators. This programmatic dismissal of compelling evidence appears to be present in the sustainability political discourses. Despite advances in ecological science and systems theories that have seriously challenged self-regulating equilibrium seeking eco-systems, it has remained a powerful vision of a utopian social and ecological governance model and helped construct political sustainability development programmatic discourse (see, for example, Oels, 2005; Porrit, 2005; WCED, 1987).

Curtis argues that as developed societies became disillusioned with representative politics and central government, self-organising networks became a model for new ways of

governing societies without a strong centralised political structure (see also Beck, 1992, Dean, 1999, 2007) and in global visions of sustainability and inter-connectivity (Forrester, 1971; Lovelock, 2000; Ward, 1966). Although many of these ideas emerged from counter-culture movements in the 1960s and 1970s, they were later hybridised with other powerful anti-government programattic discourses such as the neo-conservative discourse, most visibly in the USA and UK in the 1980s. This hybridisation continued, despite scientific challenges to the theory of the self-regulating ecosystem (Gleick, 1987; Waldrop, 1992) and the emergence of scientific consensus of natural systems as non-equilibrium systems constantly changing in unpredictable and chaotic ways.

In the social sciences, including accountancy, the self-governing, equilibrium seeking, invisible hand of the market has been extensively criticised for its unacceptable social consequences and unacceptable, some would argue catastrophic, effect on the natural environment (see, for example, Gray, 2002; 2010; Cooper, 1992; Maunder & Burritt, 1991). Nevertheless, it would appear that there is much greater acceptance of the invisible hand of eco-systems and natural order in political sustainability programmatic discourses, and potentially in some social scientific programmatic discourses, without an explicit consideration of the social consequences of autopoietic governance. Social self-governance systems tend to obscure the problems of unequal distributions of power and resources in the world today. Trying to replicate that natural myth in social governance is, in our view, both flawed in logic and highly problematic, particularly when some groups in society have much more powers and control of resources than others. The inability of self-organising systems to deal with politics, coupled with a general disillusionment of politics and politicians has, somewhat paradoxically, made eco-system cybernetic models more attractive.

4. DISCUSSION

"We never talk about power these days. We think we live in a non-hierarchical world, and we pretend not to be elitist now – which is, of course, an emotionally attractive idea, but it's just not true. And that's dangerous."

Adam Curtis (quoted in Viner, 2011)

In this paper, we have argued that 'Nature' has been incorporated into sustainability programmatic discourses using mediating instruments based largely on machine metaphors and a myth of natural balance. At the same time, this notion of natural balance also persists in non-scientific discourses such as first world creation myths, romanticism (Morris, 1892) and deep green philosophy (Naess, 1989, Carson, 1961). Faith in the idea of a self-regulating eco-system appears to be deeply embedded in popular systems of thought, as are notions of an underlying order and balance to the world and human societies. Consequently, when politicians and experts used the utopian notion of an orderly, self-regulating world to critique and problematize existing systems of governing society and nature, and as a blueprint for rebuilding an orderly world, there was very little resistance. This blueprint hybridised into other theories of social governance and reformed existing programmatic discourses; for example, networks not hierarchies, freedom for all, no class distinction and no nation states. It established seductive visions of democracy without leaders, and stable sustainable global capitalism run by computers.

As a consequence of the emergence of these visions and solution templates, self-regulation and natural order challenged the notion that governments and social institutions could change the world for the better, and organised social agency was problematized and discredited.

Natural order would be established through individual actions co-ordinated through neutral networks of computers. There was a policy shift away from governments seeking social and ecological emancipation, towards a managerial role that viewed individuals as cogs in a machine that helped the system balance itself. The politics of change has been discredited and there is a view that instead we should passively submit to 'natural' forces that will bring about natural order and balance (Viner, 2011). However, cybernetic governance does not remove power from governance, but rather *depoliticises* governance (Beck, 1992; Dean, 1999, 2007), into a form of managerialism that privileges process over vision, and transfers powers to new unelected elites such as financial institutions, corporations and international institutions such as GATT and the World Trade Organisation. According to Curtis, this shift in power was accomplished under a programmatic discourse of individualism and the freedom of the individual arising from the market, with the result being that any challenge to the dominance of the market is framed as challenging the natural order and upsetting the balance of nature.

The extensive use of eco-systems in the sustainability policy arena clearly parallels Curtis's wider social critique. For example, he refers to the Club of Rome hybrid and its role in the emergence of sustainability as a global concern. The Club of Rome model dominates the international policy discourse and has played a powerful role in legitimating concerns for developing sustainably, yet it was built using false assumptions on self-regulation and natural balance. A major concern of this model was not how it was used to diagnose the inescapable wrongs of the world in 1970s, but rather how this model was subsequently adopted as a template/mediating instrument to solve these wrongs. These solutions involved reducing human agency, accepting existing levels of gross social inequality and an underlying assumption that humans were incapable of change.

The documentary series produced by Curtis (2011), and our subsequent exploration of his claims in this paper, appears to challenge some of the scientific legitimacy of the sustainability programmatic discourse and the way in which this discourse is being translated into local processes and practices. This political sustainability programmatic discourse permeates sustainable accounting research and processes and practices. We argue that a more critical analysis of how eco-systems hybrids have impacted on the political sustainability programmatic discourse, and how this programmatic discourse has impacted upon science, is required and could have significant implications for the exploration of appropriate forms of sustainability accounting. This paper is our first attempt to articulate our concerns over the use and abuse of particular forms of eco-systems thinking. These concerns focus on particular eco-system hybrids that contain challengable assumptions on how nature is and how it 'governs' itself to establish natural balance, especially when contemporary studies of nature directly challenge the notion of natural balance or order.

Sustainability as political and scientific programmatic discourse is founded on systems thinking and contains different systems based hybrid objects that contain notions of autopoiesis. Autopoietic systems generate and process signals from critical feedback loops causing corrective action in sub-systems to maintain order and balance in the system. Systems that describe 'nature' as eco-systems justifiably form part of any sustainability discourse and eco-systems are similarly autopoietic in their construction. It is important to emphasise that we do not argue for the exclusion of natural systems in the sustainability political discourse (or as mediating instruments), but rather that we are concerned with the validity and appropriateness of the way in which nature is represented in this discourse, and how problematic assumptions of natural systems are then hybridised with problematic

assumptions of social systems to create 'natural solutions' to our unsustainability. The solutions, which can be seen as mediating instruments, tend to diminish the role of human agency and social intervention, obscure and automate forms of governance, and lock in existing power and resource distributions. Some of these 'sustainable' mediating instruments can be seen to act *against* notions of accountability, social engagement and learning, transparency, anti-dialogic and privilege the unsustainable *status quo*.

Sustainability science makes extensive use of systems notions, while systems thinking has been foundational in creating and communicating our knowledge of the criticality of our unsustainability. Systems have also been used, we would argue less effectively, in the political discourse in constructing 'solutions templates' to our unsustainability. The Club of Rome eco-system hybrid, and the related notion of limits to growth, have been effective in problematising the environmentally destructive nature of our lifestyle. However, the solutions that emerged from this eco-system hybrid are problematic in terms of their social and environmental assumptions. For example, the Club of Rome hybrid did not allow for human learning or adaptation to changing circumstances, nor did it allow for a substantive redistribution of resources. Critics argued that the Club of Rome solution institutionalised and legitimated the divide between the developed and developing world in the 1970s and was founded on an individualist view of the humanity and an untested utopian vision of a network society automatically controlled by computers.

Feedback loops and self-governing mechanisms feature strongly in the accounting research literature, with accounts conceptualised as providing essential information on the performance of organisations that allow others to 'automatically' evaluate the organisations performance and take corrective action to bring the organisations performance back in line with its desired performance. Accounts provide the signals and knowledge to allow corrective action and establish balance and order. Within the critical and sustainability accounting research literature, the invisible hand of capitalism and equilibrium seeking markets has been extensively critiqued and considered incompatible with social governance, yet strangely there seems to be a far greater acceptance of invisible hands associated with theoretical models of nature and with the balance and order of nature.

5. CONCLUSIONS

It is overly simplistic to view all eco-system hybrids as the same or as sharing a common intellectual basis or scientific heritage. We argue that the eco-system hybrids that draw least from empirical studies of nature, and that are most 'machine-like' in their regulating mechanism and sense of order, are the most powerful mediating instruments. We further argue that machine-like eco-systems hybrids are inappropriate and inadequate mediating devices for sustainable transformation. We do not suggest that natural, social and economic dynamics are not inter-related, inter-connected or complex and occasionally appear to be in equilibrium or possess mechanisms that regulate system behaviour. However, we have argued that particular eco-system hybrids that over-simplify these systems and rely on mathematical equations or computer simulations that ignore or deny empirical observations of that which they seek to model are problematic. These eco-system hybrids do serve a useful scientific purpose within scientific discourses, but are problematic when they are transferred from scientific programmatic discourses to political programmatic discourses and then hybridised with other disciplines in an unreflective or uncritical manner to construct solutions.

We present our initial evaluatory framework to make visible some of the implicit assumptions with eco-systems, in order to help evaluate different eco-system hybrids as appropriate mediating instruments, and to critically reflect on their contribution to the political programmatic discourse and in implementing sustainable change. Understanding eco-system behaviour, and in particular understanding appropriate feedback mechanisms, is extremely useful for sustainable accounting processes and practices. Sustainable accounting should be closely aligned with these critical feedback loops, and work with sustainable dynamics rather than against them (Gray, 2010). Eco-system thinking can help identify appropriate sustainable entities, sustainable dynamics, different concepts of predicting behavoirs and modelling social, ecological and power distribution consequences, appropriate regulatory mechanisms and the role of human agency. All of the above issues are central to the emergence of sustainable accounting and sustainable societies, but only if the underlying eco-systems are representative of ecological and social realities.

If the concept of sustainability has as one of its pillars the 'social', then it is difficult to see how an autoregulated system based on cybernetic, machine-like representations of nature that are ideological, rather than empirical, can bring about genuinely sustainable transformations. We argue that we should seek to make the invisible hands – both in reality, as well as in programmatic discourses – visible, and subject to authentic social engagement and dialogue. It is difficult to see how sustainability could emerge if sustainable governance is founded on a conceptual model and programmatic discourse that does not accurately represent natural and social behaviour. What form, if any, this sustainability-system hybrid might take, and what its appropriate set of visible hands might be, is beyond the scope of this exploratory paper. However, we do argue that there are major problems with the way in which certain eco-system hybrids have been privileged over others and express our concern that if they are allowed to translate or corrupt the programmatic discourses associated with sustainability into new local hybrid sustainability processes and practices then they will at best allow the current crisis to perpetuate.

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