

**School of Humanities  
Curtin University Sustainability Policy Institute**

**Making Viability Sustainable**

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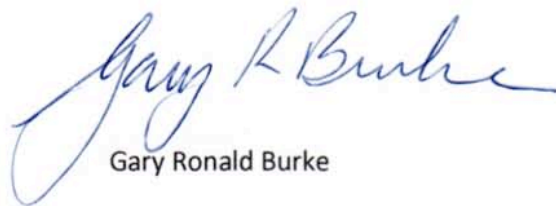
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## Declaration of originality

I declare that this thesis is my own account of my research and contains as its main content work that has not previously been submitted for a degree at any tertiary institution.

A handwritten signature in blue ink that reads "Gary R. Burke". The signature is written in a cursive style with a large, looping initial 'G'.

Gary Ronald Burke



# Making Viability Sustainable



**For Emily, Declan and Amy**





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**Abstract**

Conventionally, the neoclassical economic discourse is used to interpret sustainability. Sustainability is regarded as an economic problem and sustainability policies focus on maintaining various forms of capital. This approach is conceptually inadequate and it is unable to recognise or correct systemic non-sustainability that perpetuates unsustainable behaviour.

This thesis challenges the epistemological authority of neoclassical economics as being an appropriate policy framework for creating effective sustainability policy.

The extent, significance and persistence of sustainability issues suggest that remediation is beyond the capacity of conventional policy approaches. The new understandings of complexity and uncertainty make new conceptual and methodological demands on policy makers. The dominance and intransigence of the neoclassical economic episteme means that changes towards sustainability are more than simple reform processes; conceptual and cognitive change is needed.

This thesis suggests that economics needs to be, and can be, reconceptualised and reframed within a sustainability-informed ontology that includes economic, social, cultural and ecological layers. It describes a Viability Analysis framework that accommodates pluralist, multidimensional viability constructs. It proposes a sustainability-informed system of national accounts in which economic activity is recalibrated with qualitative data within a reconceptualised sustainability-informed taxonomy of categories. The sustainability-informed system of national accounts provides policy makers and businesses with information that can be used to steer economic activity towards sustainability paths. Using an opt-in approach, businesses can qualify for lower tax rates by demonstrating their movement towards sustainability. By framing economics within a sustainability-informed ontology and accounting narrative, a symbiosis between economics and sustainability is possible so that sustainable behaviour can be economically viable, and economic viability can be sustainable.



## Chapter 1: The research question and thesis structure

### 1.1 Introduction

Since 19<sup>th</sup> century industrialisation in Europe, the neoclassical economic paradigm has been the main framework for economic development policy. Currently neoclassical economic discourse is used to frame sustainability and provide the ontology and language of policy. It provides the theoretical framework for formulating and assessing the viability of sustainability policy initiatives. As Bressers and Rosenbaum (Bressers and Rosenbaum, 2000) explain:

*In virtually all Western societies, 'economic rationality,' an orientation towards solving problems and satisfying human needs as efficiently as possible, is a dominant functional rationality. p533*

This thesis challenges the epistemological authority of neoclassical economics as the appropriate paradigm for sustainability policy, but it supports a free enterprise, liberal democratic society with its emphasis on individuality and creativity.

More and more commentators are expressing the view that standard economic concepts of value and efficiency, and their dependence on market prices, can no longer provide adequate indicators for sustainability policies (Espinosa and Walker, 2011, Gowdy, 1999, Lowe, 2009, O'Connor, 2002). Clark (Clark, 1991b)

encapsulates these perspectives:

*... 'economics' – especially neo-classical theory as developed in the Western gestalt – can no longer take center stage in our thinking, forcing our understanding of ourselves and our universe to conform to it. Instead, we need to reexamine our assumptions about human nature and human needs, about the meaning of "wealth" and "wellbeing," and about appropriate ways to achieve global sustainability. p410*

The thesis is framed by the new awareness that complexity theory brought to light in the last part of the 20<sup>th</sup> century. These new understandings of complexity together with the evolution of the sustainability concept have changed the nature of the economic problem and the context within which economic theory and policy operate. As O'Toole (O'Toole, 2004) writes, dealing with complexity is a cognitive challenge because it means

*... finding manageable ways of taking into account changing cognitive circumstances, changing empirical circumstances, and persisting uncertainties for even as knowledge and information develop, one can expect uncertainty to be a permanent aspect of policy action. p44*

Economic perspectives are an essential component of effective sustainability policy and economics has a critical role to play in the transition to sustainability. An economically robust society is likely to be more sustainable than one that is poverty-stricken and/or socio-culturally dysfunctional.

However, sustainability issues are complex and multidimensional. Many arise as the unintended consequences of modernism. A lack of symbiosis between sustainability and economics leads to conflictual goals and ineffective policies across the globe. There is a range of conceptual, epistemological<sup>1</sup>, ontological<sup>2</sup>, methodological, cognitive and analytical issues that have prevented this schism from being healed.

The legacy of this dysfunctional relationship suggests the underlying reason for this research: in the neoclassical economic paradigm, sustainability is often not economically viable, and economic viability is often not sustainable. This research focuses on the diversity of changes needed to create the missing symbiosis between sustainability and economics so that a new approach could be developed.

Sustainability requires an economics that can focus on management within limits prescribed by a biosphere with finite capacities. As Christensen (Christensen, 2001) states:

*The dependence of modern industrial systems on vast but depletable supplies of inorganic material and energy resources and on biological systems of*

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1 "Epistemology is a philosophical inquiry into the nature of knowledge, what justifies a belief, and what we mean when we say that a claim is true." ALCOFF, L. (1998) *Epistemology : the big questions*, Malden, MA, Blackwell Publishers. P viii; "Epistemology...divides into two parts: individual epistemology and social epistemology. Individual epistemology ... needs help from the cognitive sciences. Cognitive science tries to delineate the architecture of the human mind-brain, and an understanding of this architecture is essential for primary epistemology. Social epistemology needs help from various of the social sciences and humanities, which jointly provide models, facts, and insights into social systems of science learning, and culture. Within primary epistemology, then, the objects of epistemic evaluation are cognitive processes, structures and mechanisms...." GOLDMAN, A. I. (1986) *Epistemology and cognition*, Cambridge, Mass., Harvard U.P. p1

"Social epistemology is concerned with the truth-getting impact of different patterns and arrangements of social intercourse." GOLDMAN, A. I. (1986) *Epistemology and cognition*, Cambridge, Mass., Harvard U.P. p5

2 "An ontology refers to fundamental, taken-for-granted assumptions about the ultimate reality of things." SLIFE, B. D. (2004) Taking Practice Seriously: Toward a Relational Ontology. *Journal of Theoretical and Philosophical Psychology*, 24, 157-178. p157



*considerable vulnerability must be built into the structure of economic theory. Technological change not only discovers new resources, products and processes, it also increases the scale of use of resources relative to existing ecosystems and the biosphere. p30*

The question is whether neoclassical economics can meet the needs of effective sustainability policy. Protagonists of the neoclassical approach to economics acknowledge that their discipline has faults and weaknesses, but they claim that it remains the best approach available.

It is reasonable that many modern economists believe that contemporary neoclassical economics has the appropriate approaches and policy tools to ameliorate complex issues such as climate change, resource depletion, poverty and pollution. Krugman claims (Krugman, 2010) that economics is ready and able to solve climate change issues<sup>3</sup> with pricing policies, and the constraining factor is lack of political will.

This thesis contests such a position and aims to show that neoclassical economics does not have the capacity to resolve complex issues such as climate change. It argues that the “ostentatious appearance of rigour and neutrality” (Bourdieu, 2005) (p220) that characterises neoclassical economics masks its inadequacy as a policy framework; that neoclassical economic methodology and jargon creates an illusion of coherence that masquerades as validity among policymakers and the broader community. The result of this pseudo competence of neoclassical economics is further complicating sustainability issues rather than remedying them. The self-referentialism, myopia, lack of reflexivity and closed-shop approach of neoclassical economists precludes consideration of other options for free-enterprise economics that are compatible with sustainability. It is argued here that the evolved sustainability concept can provide a way to reclaim economics as a useful analytical and management tool.

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<sup>3</sup> “...We know how to limit greenhouse-gas emissions. We have a good sense of the costs — and they’re manageable. All we need now is the political will.” KRUGMAN, P. (2010) Building a Green Economy. *The New York Times*. New York, New York Times. I argue that this is a grand delusion of economism.

The Tragedy of Economism describes the consequences arising from continued use of the neoclassical economic paradigm for sustainability policy. Two decades ago Frow (Frow, 1992) posed the question:

*How has it been possible for a discipline as intellectually shoddy as neoclassical economics, all of the key categories of which (the market, equilibrium, the individual) have long since been subjected to thorough philosophical critique... to gain such a sway over the most powerful institutions of economic decision-making ... John Frow (Frow, 1992) cited in (Davis, 2008) p250.*

Most studies of the relationship between economics and sustainability focus on ways in which sustainability may be made economically viable. In contrast, this research explores options and possibilities for making viability fit within a sustainability framework. That is, how to reconceptualise the discipline of economics in ways that are practical, relevant and compatible with a free market system but symbiotic with sustainability: making viability sustainable. However, neoclassical economics is firmly entrenched in the policy world and, as Keynes (Keynes, 1973) wrote:

*The difficulty lies, not in the new ideas, but in escaping from the old ones. p27*

There are many criticisms of neoclassical economics that are well known and long standing. The approach taken here is to explore the cognitive, conceptual, epistemological and ontological underpinnings of neoclassical economics so that the factors enabling its persistence and pervasiveness can be understood. This is a precursor to bringing about change. Transcending the cognitive and conceptual framework of the neoclassical economic ontology is not merely a question of pointing out inadequacies and suggesting reforms. A sustainability-informed ontology is needed to provide the framework in which economic issues are analysed. How to bring this about is the objective of this thesis. A cognitive scientific revolution is called for (Andersen et al., 2006) because neoclassical economics is deeply embedded in the cultural episteme that itself is perpetuating unsustainable behaviour.

The innovative approach suggested in this thesis is that the neoclassical economic paradigm needs to be reconceptualised within a sustainability-informed ontology so

that economic issues can be reframed within a sustainability-informed policy framework. Far from being anti-development, this proposed shift would help show that appropriate progress can support the environment, and that humans can have a positive impact on the planet. At the time of writing, 2012, there are no approaches to policy in which economics is *embedded within a sustainability framework*.

This thesis assumes the intentions of policy makers are to move towards sustainability, that they are persons of good will, not driven by inherent greed, arrogance and antipathy. Greed, arrogance, ignorance and antipathy may remain, but overcoming those traits is unlikely to happen soon enough to ameliorate the conditions now confronting humans. A systemic policy approach is needed that rewards and encourages sustainable behaviours and activities. The aim of this research is to describe a policy framework in which effective sustainability policy is possible, and in which sustainable behaviours are facilitated and encouraged by the systemic parameters of the economic policy framework.

The stakes are high and the timeframe urgent: the imperatives for effective sustainability policy indicate that a more cogent economic paradigm is needed that is symbiotic with sustainability. As Joseph Campbell (Campbell, 1973) reminds us:

*The rise and fall of civilisations in the long, broad course of history can be seen to have been largely a function of the integrity and cogency of their supporting canons of myth... Pp3-8*

Reconceptualising economics within a sustainability-informed ontology offers the prospect of avoiding biophysical and socio-cultural collapse, and saving economics from policy irrelevance. Cognitive and conceptual changes create the opportunity for sustainability to be a practical policy pathway for resolving current crises.

This thesis aims to explain why this is necessary, and how to bring it about.

## **1.2 Research question**

The research question addressed in this thesis is:

*How can an economic framework be created to facilitate effective sustainability policy?*

The specific objectives of the research are:

1. to demonstrate the need for a change in contemporary policy processes in order to facilitate effective sustainability policy
2. to demonstrate the role of neoclassical economics as the dominant episteme in which sustainability policy is formulated, and the inadequacy of neoclassical economics in dealing with complex sustainability issues
3. to explain how the concept of sustainability has evolved and explain how it can function as a cultural narrative, and provide a framework for policy implementation
4. to explain the ways in which economics can be reconceptualised and reframed within a sustainability-informed ontology so that it becomes symbiotic with sustainability principles, parameters, perspectives and processes
5. to explain the conceptual foundations of a sustainability-informed system of national accounts.

This thesis is a theoretical analysis, based on original ideas augmented by secondary sources.

### **1.3 Thesis structure**

The thesis is structured in 13 chapters.

#### *Chapter 1: Introduction and research question*

The introduction explains the aims of the thesis: that is, how economic theory can be reconceptualised and reframed within a sustainability-informed ontology, and how a sustainability-informed approach to economics can work with a market system to provide economic management that is sustainable. The focus is on changing the nexus between sustainability and economics so that it is symbiotic and co terminal. The overall change means that economic issues are framed and addressed within sustainability parameters, principles, perspectives and processes. That is, sustainability sets the agenda for economics, rather than economics

proscribing how much sustainability is affordable. It is a cognitive revolution that is being suggested.

*Chapter 2: The imperatives for effective sustainability policy*

Contemporary policymakers are confronted with complex issues that threaten life support systems on the planet. Chapter argues that the urgency for effective action for sustainability is not merely a question of the extent and significance of the issues themselves, but also the adequacy of policy frameworks and conceptual tools available to deal with the issues needs to be considered.

The persistence and pervasiveness of significant, life-challenging issues suggests that effective remediation is beyond the capacities of conceptual and methodological aspects of contemporary policy processes. The imperatives for effective sustainability policy mean that there is now both the requirement and the opportunity to reframe the approaches to contemporary issues so that the ways in which policy is addressed are more appropriate to the complex nature of the issues.

*Chapter 3: Complexity and sustainability policy*

Complexity and uncertainty now permeates all our contemporary understanding of reality. Chapter 3 argues that complexity and uncertainty must also inform all our policy and management responses, and that institutional structures and processes may need to adapt accordingly.

*Chapter 4: Sustainability: concept, aspects and context*

Sustainability arose as a 20<sup>th</sup> century conceptual development and policy goal. Chapter 4 analyses the multiple aspects of the concept of sustainability and highlights the critical features that need to be considered in order to realise adequate sustainability policy and its implementation.

*Chapter 5: Neoclassical economics and sustainability: Aspects and impacts*

This thesis challenges the notion that neoclassical economics is the most appropriate economic framework for sustainability policy in a free market system. Chapter 5 shows that neoclassical economics is a cultural narrative, an intellectual

construct, a doxa, or belief system that that has evolved from abstractions<sup>4</sup>, metaphors, aphorisms and narratives grounded in 18<sup>th</sup> century Scottish philosophy.

Using neoclassical economic interpretations of complex issues leads to policies that focus on sustainability as a problem of maintaining various forms of capital. This approach is inadequate and unable to recognise or correct the systemic non-sustainability that perpetuates unsustainable behaviour.

*Chapter 6: The interface between sustainability and neoclassical economics*

Chapter 6 explains the need for changing the role of economics in the sustainability policy process. It discusses the grounds for challenging the epistemological authority of neoclassical economics as the predominant ontology for framing sustainability policy.

The chapter analyses aspects of neoclassical economics that create inertia against changes within the discipline, rather than criticising neoclassical economics *per se*<sup>5</sup>.

*Chapter 7: The tragedy of economism: Implications of the intransigence of neoclassical economics*

This chapter shows that neoclassical economics has evolved into a belief system, or doxa, that is still grounded in 18<sup>th</sup> and 19<sup>th</sup> century understandings, metaphors and aphorisms that are no longer adequate for understanding contemporary biophysical and socio-cultural issues.

Neoclassical economics is a resilient paradigm that has withstood long-standing criticism; repeated calls for change and adaptation go unheeded<sup>6</sup>.

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<sup>4</sup> "Abstraction ... is the process (or, to some, the alleged process) in concept-formation of recognizing some set of common features in individuals, and on that basis forming a concept of that feature." <http://en.wikipedia.org/wiki/Abstraction> (NP)

<sup>5</sup> "One could ... spend a good deal of time and energy in trying to convince those who engage in macroeconomics, econometric model building, general equilibrium theory and so on, of the folly of their ways. But, that task accomplished, there would be nothing left but for the whole profession to shut up shop." EARL, P. E. & MAY, N. M. (1992) How Economists can Accept Shackle's Critique of Economic Doctrines without Arguing Themselves out of their Jobs. IN BLAUG, M. (Ed.) *Joan Robinson (1903-1983) and George Shackle (1903-1992)*. Aldershot, England, E. Elgar Pub. Co. P38. Some analysts have pointed out this as a possibility; see for example CODDINGTON, A. (1983) *Keynesian economics : the search for first principles*, London, Allen & Unwin..

<sup>6</sup> For instance, Nordhaus and Tobin wrote in 1973: "Disillusioned critics indict both economic science and economic policy for blind obeisance to aggregate material "progress," and for neglect of its costly side effects. Growth, it is charged, distorts national priorities, worsens the distribution of income, and

Here, this is termed the Tragedy of Economism because it means that policy makers are without an intellectually valid or practical framework to frame policy to address complex contemporary issues.

*Chapter 8: Framing the change processes needed for sustainability*

More than good ideas and/or new information are needed to bring about change.

This chapter suggests that the necessary changes can be achieved conceptually and cognitively.

It argues that the process of changing economics to make it symbiotic and compatible with sustainability requires cognitive change, reconceptualisation of analytical tools, reframing of approaches and contexts based on sustainability-informed ontological change. In other words, the complete process from cognition (ways of thinking) to epistemology<sup>7</sup> (ways of knowing) and ontology (ways of ascribing significance) to conation (ways of doing) need to be addressed.

*Chapter 9: Reframing and reconceptualising economics within a sustainability framework: viability analysis*

Because economics is regarded as the language of policy, the current tendency is to reframe scientific understandings in terms that fit the neoclassical economic criteria to ensure funding.

Viability is a crucial concept: how it is constructed and how it is used to validate policy and create acceptance in the broader cultural milieu. Chapter 9 argues that a sustainability-informed viability framework can lead to a more immediate and effective policy response to complex issues. Such a framework is developed and presented in this chapter.

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irreparably damages the environment. Paul Erlich speaks for a multitude when he says, 'We must acquire a life style which has as its goal maximum freedom and happiness for the individual, not a maximum Gross National Product.'" NORDHAUS, W. D. & TOBIN, J. (1973) *Is Growth Obsolete?* IN MOSS, M. (Ed.) *The Measurement of Economic and Social Performance, Studies in Income and Wealth*. Pp510

<sup>7</sup> "Epistemology is a philosophical inquiry into the nature of knowledge, what justifies a belief, and what we mean when we say that a claim is true." ALCOFF, L. (1998) *Epistemology : the big questions*, Malden, MA, Blackwell Publishers. P viii; "Epistemology deals with affairs of the intellect... Epistemology is the study of methodology, and proper methodology is the province of deductive logic, inductive logic, probability theory, and statistics." GOLDMAN, A. I. (1986) *Epistemology and cognition*, Cambridge, Mass., Harvard U.P. p2

*Chapter 10: Aligning the system of national accounts with sustainability policy requirements*

The system of national accounts is a crucial tool for formulating, implementing and evaluating sustainability policy. However, the existing system of national accounts has no instrumental compatibility with sustainability. Chapter 10 suggests that sustainability-informed national accounting system is needed to provide a socio-cultural narrative as well as qualitative indications of economic activities.

A restructured taxonomy of sustainability-informed categories can organise data in ways that are compatible with effective sustainability policy.

*Chapter 11: Conceptual underpinnings of a sustainability-informed system of national accounts*

There have been many attempts at creating 'green' systems of national accounts. They provide augmented data about non-market aspects and impacts, but their data are distilled into monodimensional money units that do not convey the depth, breadth and interconnectedness of complex issues. Satellite accounts remain marginalised to the main system of national accounts.

Quantification, monetisation and aggregation (QMA) are the principle methods used to establish significance and credibility in the neoclassical economic policy process.

A reconceptualisation of the structure of the system of national accounts to incorporate qualitative data is presented here. It involves restructuring the national accounts and recalibrating what aspects describe economic activity. It requires development of a sustainability-compatible taxonomic structure to frame the national accounts. It ascribes sustainability-derived attributes and metaproperties to economic activities that are organised in the accounting narrative within sustainability-informed categories.

*Chapter 12: Towards a sustainability-informed policy framework*

Chapter 12 discusses the main parameters, principles, perspectives and processes that are necessary for a sustainability informed policy framework.

*Chapter 13: Conclusion and suggestions for further research.*



## Chapter 2: The imperatives for effective sustainability policy

### 2.1 Introduction

In this chapter I explore the reasons why change is needed to move towards effective sustainability policy. A key driver for this thesis was to investigate the reasons for limited progress on sustainability issues *in spite of* the vast accumulated knowledge of the extent and significance of the problems, and the vast resources and efforts that have been applied to them with so little apparent benefit.

Humanity is now at a point where the slow policy changes have become alarming in the face of the urgency of the issues and the need to act quickly. But these are not new issues; why have they been allowed to persist? Why are they not already resolved? Are we being alarmist?

If you look hard enough, the news is sobering, but not all bad. People no longer smoke on aeroplanes or in buses, and there has been some progress toward remediation of environmental issues:

*In the United States, for example, air quality has improved significantly in almost every major city since 1970. Modest improvements also have occurred in aggregate measures or national averages of water quality, with major progress made in various locales. Moreover, although 8 billion pounds of toxic chemicals were released into the environment in 1999, a 46 percent decrease in these releases has taken place since 1986. (Durant et al., 2004) p2*

However, in the broader scale of things, the changes towards sustainability have been 'very modest indeed' (Lafferty and Meadowcroft, 2000) p445. Lowe (Lowe, 2009) states that it is "impossible to over-state the urgency of our situation" p77. The aim of this chapter is to investigate the aspects of the issues being addressed in order to understand why they have not been ameliorated.

The phrase used by Kohn et al., 'the imperative of sustainability' (Kohn et al., 1999a) p3, is adapted here to frame the significance of the issues being confronted: that is, the imperatives for effective sustainability policy.

In this chapter, different types of sustainability imperatives are discussed in order provide a basis for the broader approach taken in this thesis.

## 2.2 Framing the issues: the myth of hindsight

The 'Myth of Hindsight'<sup>8</sup> is a conceptual framing tool developed in a previous work (Burke, 1996) to help frame the socio-cultural contextual factors affecting the persistence of social or environmental problems. It is a type of conceptual tool that Wilber calls an 'orienting generalisation' (Wilber, 1995) designed to help frame a different perspective on existing issues. Basically, the Myth of Hindsight is the notion that 'if they had known better, they would have done it differently'. I researched situations in environmental and economic history where scientific warnings were made but over-ruled. When the warned-about-consequences did emerge, the cultural myth is created: the actions were undertaken because of ignorance; 'had we known better, we would have done it differently'. The Myth of Hindsight reminds us that current day legacies of past actions are not a result of lack of information: 'they did know better but they did it anyway'. Persistent issues are not merely questions of information-deficit!

Rothschild (Rothschild, 2001) uses the term 'processionalism' to describe a historiography in which history is regarded as a mere description of how we got to our present condition: how did events unfold that delivered us to where we are now. However, the processionalist historiography hides key aspects that are relevant and needed when analysing change processes: history needs to focus as much about the decisions that were not taken, as about what was eventually done (Poovey, 1998). Processionalist history creates a type of 'arrogance of the present' generation. By contrast, historical epistemology (Poovey, 1998) frames historical analysis in ways that try to empathise with those in the past, to understand the cultural and epistemic context in which they were working.

The Myth of Hindsight is mythical because it is a social narrative that is commonly accepted and perpetuated across generations and disciplines, more or less invisible or 'outside the radar' of researchers in the normal course of events. The fact that it

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<sup>8</sup> I lean to the Joseph Campbell's approach to mythology CAMPBELL, J. (1973) *The masks of God*, London, Souvenir Press (Educational & Academic)., I use the term here in the sense of myth being a cogent but tacit worldview that underpins socio-cultural behaviour without the individual being necessarily aware of the influence on a daily basis. Myths may be invisible, but they are entrenched and powerful.

is a myth does not diminish the power that this way of thinking has derived because it is commonly believed.

Awareness of the Myth of Hindsight poses the questions as to why and how the information was over-ridden. Reframing the issues enables a distinction to be drawn between a legacy that is the result of an information deficit ('they didn't know any better') and a legacy that stems from epistemic arrogance ('they did know better but they did it anyway'). The Myth of Hindsight shows that the legacy of the past is not just a function of ignorance and circumstance: there were cognitive dimensions as well as contextual or epistemological factors that need scrutiny if we want to use history as a way of understanding the present.

The Myth of Hindsight masks the historical decision-making processes that created avoidable legacies for current generations. For instance, the causal relation between over-clearing of native vegetation and salinisation of the soil in Western Australia was known early in the 20th century (Wood, 1924); the overexploitation of native jarrah forest was warned about in a Royal Commission in 1904 (Harper et al., 1904)<sup>9</sup> and the first conference on climate change was held in Fremantle in 1988. The Ord River Project in Western Australia encountered significant insect problems after the land was irrigated, resulting in huge amounts of pesticides being used. It was touted as an unexpected consequence, whereas, in fact Walker (Walker, 2001) explains:

*In Western Australia, the government entomologist discovered as long ago as 1945 that all known major pests of cotton were present at the site of the proposed Ord River irrigation scheme. Pp272-273*

The Myth of Hindsight helps draw attention to the fact that 'we did know better but we did it anyway'. It helps understand the unsustainable legacies that are encumbering the current generation. Hopefully the Myth of Hindsight can be used to gain a better understanding of the processes of unsustainability to protect future

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<sup>9</sup> "State acquiescence in the destruction of good timber only because the export trade demands it, is a crime against coming generations...All countries seem now to realise the importance of stopping the reckless waste and making provision for the future...the longer it is delayed the more difficult the task.' May, 1904. HARPER, HASTIE, ATKINS & MOORE, N. J. (1904) W.A. Royal Commission on Forestry Final Report. Government Printer, 1904 (400 copies) Pp 10-14.

generations. The Myth of Hindsight shows that ignorance and information deficit are not necessarily the main issues that create unsustainability: culturally authorised arrogance plays a part and needs analysis.

By acknowledging that we are not the first to address an issue, the Myth of Hindsight shows that we can learn from history: not only that which eventuated, but also what was not tried, and what was overridden. This can help analysts garner some ideas as to why it was not implemented, other than 'they didn't know better'.

The Myth of Hindsight provides a way of reframing issues in terms of why they have not already been resolved; we can look at the context in which they were being addressed, but with the benefit of hindsight: We know what happened, how did they process the information and uncertainty of the time to arrive at the decision that they did. What has changed, what has not changed, in our approach to these issues? Poovey (Poovey, 1998) uses the term historical epistemology to explain a similar approach.

The Myth of Hindsight helps frame present blockages by drawing parallels with those addressing similar issues in the past. Understanding the decision-making process with the benefit of hindsight, in a similar, but different context, may lead to more success in policy formulation and implementation for complex issues.

Using the Myth of Hindsight as a framing tool helps create a new perspective for examining the persistence of issues and barriers to change. We can look at the reasons why a long-standing problem has not already been solved; why it remains 'invisible' (culturally naturalised), or why it remains culturally legitimised when it is clearly non-sustainable. The Myth of Hindsight suggests that the etiology of intransigence is an important aspect for sustainability analysts to focus on.

In some ways, contemporary conditions parallel other times in history when paradigm shifts have been necessary because of the inadequacy of the dominant epistemic framework. The 18<sup>th</sup> century French chemists realised the discovery of oxygen exposed the deluded thinking that perpetuated phlogiston theory, requiring them to:

*... forget all that we have learned, to trace back our ideas to their source, to follow the train in which they rise, and, ... to frame the human understanding anew. ... after all, the sciences have made progress, because philosophers have applied themselves with more attention to observe, and have communicated to their language that precision and accuracy which they have employed in their observations: In correcting their language they reason better. The Abbé de Condillac, quoted in (Lavoisier, 1790) Preface*

Abandoning phlogiston theory was no small undertaking; it had been the dominant narrative for chemistry/alchemy for almost a century. In Lavoisier's (Lavoisier, 1790) own words:

*All these chemists [phlogistonists] were carried along by the influence of the genius of the age in which they lived, which contented itself with assertions without proofs; or, at least, often admitted as proofs the slightest degrees of probability, unsupported by that strictly rigorous analysis required by modern philosophy. (Preface)*

The changes required may be likened to the interplay of policy, scientific understandings and cultural narrative that underpinned public health reforms at the end of the 19<sup>th</sup> century (Smith, 2007): the new scientific understandings of the relations between germs and disease informed policy, but without cultural support for cleanliness (i.e. accepting the need for behavioural change) and adaption of lifestyle (i.e. accepting the new constraints on behaviour), the public health outcomes would have been significantly less effective (Waller, 2004). A broad-based supportive cultural narrative was needed to make the policy work; and without overarching policy to frame the public health initiatives, individual acts of hygiene would have been ineffective.

### **2.3 The imperatives for sustainability policy**

The imperatives for sustainability emerge from the complexity of the situations that manifest across multi dimensions, scales and contexts. They are framed in the following six inter-related aspects:

#### *1. Nature, significance and extent*

The nature, significance and extent of the issues requiring policy intervention, as well as the contexts in which they have manifested, are an urgent focus of attention. These issues are generated from the biophysical (environmental)

degradation and socio-cultural stresses<sup>10</sup> which manifest as threatened biophysical life support systems on one hand, and widening inequalities<sup>11</sup>, social injustice<sup>12</sup>, poverty and hunger on the other. Lowe (Lowe, 2009) identifies five forces underlying the sustainability crisis:

*... the growing human population, increasing consumption levels, our lifestyle choices, the technologies we use, and the pressures of the economic system.*  
Pp58-77

The issues are inter-related: Biophysical pressures from over-expansion are impacting on socio-cultural wellbeing; over-consumption creates pressure on biophysical aspects<sup>13</sup>. The scale of the issues – in spite of amazing technological progress and increases in material production – and their rate of increase are alarming: extreme climatic events, unprecedented in frequency and intensity; rates of species' extinctions; collapse of fisheries; continued extensive clearing of forests; loss of topsoil through erosion, over clearing and intensive industrial farming methods, continued starvation, hunger, poverty, disease from malnutrition and lack of basic human requirements, such as clean water and sanitation. On a global level, the issues are complex, specific to our time, and largely unprecedented. They transgress time-scales and geographical borders (Weaver and Rotmans, 2006). The interconnectedness of the way human society is organised and operates within an

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<sup>10</sup> "... besides these 'outer' limits [biophysical degradation], it is necessary to consider also the 'inner' limits inherent in human societies. Unlike all other organisms, the human kind lives, for better or for worse, in two environments: a physical one and a symbolic, non-material, cultural one, which is the product of his[her] own activity." SACHS, I. (1999) *Social Sustainability and Whole Development: Exploring the Dimensions of Sustainable Development*. IN BECKER, E. & JAHN, T. (Eds.)

*Sustainability and the social sciences : a cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. New York, Zed Books. p26

<sup>11</sup> "...although the causal link between high levels of equality and low levels of efficiency has been contested as "elusive" ..., the two countries most concerned about efficiency and the free market experienced above-average shifts in income distribution from the poor to the rich: in the UK, the so-called "Gini coefficient," a common statistical index in the social sciences to measure diversity and inequality in income and wealth within a society, rose from 0.25 in 1979 to 0.35 in 2000, while the USA saw an increase from 0.36 to 0.43 over the same period ...." WOLFF, J. & HAUBRICH, D. (2006) *Economism and its Limits*. IN MORAN, M., REIN, M. & GOODIN, R. E. (Eds.) *The Oxford handbook of public policy*. New York, Oxford University Press. p748

<sup>12</sup> "... social sustainability appears as a concern related to the internal organisation of each human society and of the world community of increasingly interdependent nations taken as a whole." SACHS, I. (1999) *Social Sustainability and Whole Development: Exploring the Dimensions of Sustainable Development*. IN BECKER, E. & JAHN, T. (Eds.) *Sustainability and the social sciences : a cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. New York, Zed Books. p26

<sup>13</sup> "...the global system of finance capital is neither rational nor capable of limiting its production to the wealth it seeks to create." POOVEY, M. (2001) For everything else, there's ... *Social Research*, 68. p418

economically and technologically globalised world has contributed to the complexity, significance and pervasiveness of issues.

## 2. Legacy

Legacies describe the consequences arising from human actions. There are positive and negative legacies that are *inherited from* past generations, and that are being *created for* future generations. Remedying negative legacies from the past can be more difficult as time passes and the issues become larger, more complex, and more apparent (Cooper and Vargas, 2004) p2. The sooner they are attended to the better. However, if contemporary resource use patterns continue, the capacity to ameliorate inherited negative legacies is diminishing. Furthermore the negative legacies being created for future generations are increasing.

Much sustainability discussion is focused on protecting future generations. This can be a problem because it supports the notion that sustainability is still an emerging issue. However, there is the pressing need to act on legacies that already exist. The welfare and opportunities for future generations *are* a major consideration, but the legacy of previous generations' lack of sustainability is already impacting on the resources and action-context of current generations. The continued lack of change in approach will make them even more difficult to resolve in the future.

To regard sustainability as a futuristic concept helps to create denial, and it can inhibit remedial action that is needed now. The legacy imperative suggests that the nature of the policy making process needs adaptation to accommodate contemporary issues:

*'Sorting things out' before decisions take place might seem a sensible approach, generally speaking, but such an option may not be appropriate for environmental questions. Policy problems are sometimes discovered only when it is nearly too late (thinning of the ozone layer) or remain difficult to prove until it may be too late (increase in global warming). Whether policy effects will be sufficient, or even to what extent they will have an impact on living conditions in 100 years, cannot be unequivocally predicted. Such predictions remain estimates that can best be characterized as "intermediate scores" or even contending positions within a continuous scientific debate. (Arentsen et al., 2000) p599*

Critical aspects of legacy issues are:

- increasing magnitude, diversity and complexity of issues
- increasing uncertainty and unpredictability
- less available resources, increased social instability, and weakened environmental resilience.

In terms of policy formulation, there are no effective economic tools for legacy management. Legacies create different challenges: there are no winners, only non-losers, and non-losing does not show up in contemporary accounting processes. Negative legacies are hidden costs.

The challenge is to create sustainability-informed tools that can help break the cycle of non-sustainable legacies. An example would be a policy framework that can implement actions across more than one generation. Currently, intergenerational viability is not a critical consideration of the contemporary policy framework; the future is discounted in favour of the present generation. Contemporary policy creates 'future eaters' (Flannery, 1994). The needs of future generations and all other species are not represented in the market system by which resources are allocated (Lowe, 2009). The calculations of economic viability are stacked in favour of the current generation of humans. However, it is the mode of calculation and the conceptualisations that underpin this disposition that provide the clues for change. These are discussed below.

### 3. *Persistence*

Many sustainability issues persist (Meadows et al., 1992) in spite of attempts at amelioration, knowledge of the significance of the problems, and the vast resources being applied in terms of research, reports, modelling<sup>14</sup>, etc. For example, although there has been vast improvement in modelling as powerful digital technologies

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14 "Methods are increasingly being developed for integrating the information available about natural and economic systems, and the question is not whether we should use models for decision-making, but what type of models they should be. That is why, according to the precautionary approach, system dynamics models which have a precise protocol and internal rigour... should allow the emergence of structural information in forms useful to support decision-making." FROGER, G. & ZYLA, E. (1998) Towards a Decision-Making Framework to Address Sustainable Development Issues. IN O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (Eds.) *Sustainable development : concepts, rationalities, and strategies*. Dordrecht ; Boston, Kluwer. p288



become available to a wider populace, progress towards remediation has been modest (Lafferty and Meadowcroft, 2000).

The issues appear defiant because they are multifaceted and deeply embedded in existing ways of being. The persistence of these issues indicates a lack of efficacy in conventional approaches and that the level of complexity of many contemporary issues may be beyond the scope of conventional policy. According to Dovers (Dovers, 2003b),

*The long term goal of sustainability and the operational challenge of sustainable development refer to fundamental, structural inconsistencies between natural and human systems. The causes of sustainability problems lie deep in patterns of production and consumption, settlement and governance. ... Considering these 'natural partners' of sustainability, and the partial and contested progress toward them over long periods of time, it is obvious that addressing sustainability is a large and long term task. p2.*

Bressers and Rosenbaum (Bressers and Rosenbaum, 2000) further stress that:

*Government, almost any government, was never conceived for the institutional management of the environment as we now understand that idea. The idea of governments "declaring" or "managing" climate policy in the offhanded way in which the international deliberations about global climate warming were described by the world media during the deliberations in Kyoto, Japan in December 1997 would have sounded faintly ridiculous a few decades ago. One of the most challenging aspects of environmental management for virtually all governments has been to adapt institutional processes, designs, and values to our awakened sensibility about environmental management. p530*

It is not suggested that the inadequacy and incapacity to deal with complex contemporary issues is malevolent. The perceived problem is that the use of outmoded and inappropriate frameworks and processes malframes the complexity being confronted, leading to inappropriate and ineffective policy outcomes. The persistence of issues suggests that new policy tools are needed to develop effective ameliorative strategies. As Rotmans (Rotmans, 2006) states:

*... the unsustainability problems humankind is faced [with] cannot be solved with current tools and methods that were applied – or seemed to work - in the past. ... the paradox is that we cannot wait for the next generation of tools and methods (and minds). p6*

In addition a cogent sustainability-informed narrative is needed. Otherwise many crucial issues are easily dismissed as 'freak events' or the result of individual cases

of aberrance (e.g. rogue traders on the stock market) and the systemic, conceptual, cognitive, ontological and epistemic aspects that actually perpetuate the issues are overlooked.

A focus on the persistence of issues can help elucidate the inadequacies of policy approaches, and shed light on the ways in which conventional approaches are suffering blind spots. For instance, the belief that humans have the capacities to control, predict or manage adverse outcomes using conventional approaches based on market forces, economic growth, engineering and technological improvement, or resource substitution needs to be challenged (Sendzimir et al., 2006).

Of course it may be that issues persist merely because of procrastination, lack of political will, or the innate human capacity to create cultural delusions. For example, in the 1990s many believed that the US economy was healthy and invincible. In 1998 the MIT economist Rudiger Dornbush wrote an article “Growth Forever” in the Wall Street Journal:

*‘This expansion will run forever; the US economy will not see a recession for years to come. We don’t want one, we don’t need one, and therefore we won’t have one... we have the tools to keep the current expansion going’. Rudiger Dornbush, ‘Growth Forever’, Wall Street Journal, 30 July, 1998, quoted in (Buchanan, 2000). p134*

The economic events since 2008 indicate that the ‘tools to keep the current expansion going’ are not as effective as economists might have once thought.

The intransigence of many sustainability issues suggests a degree of immunity to policy remediation. Beck (Beck, 2006) suggests that many policymakers are locked into

*... the autonomous dynamic of processes of modernization which have acquired an impetus of their own and which are quite blind to consequences and quite deaf to warnings of danger... the consensus regarding ‘progress’; the abstraction from ecological consequences and perils; the optimism with respect to the limits of control and supervision. The transformation of the overlooked side-effects of industrial production into ecological crisis-breeders of global import is anything but a problem of ‘the environment’, of ‘the world around us’ alone, rather, it is a profound institutional crisis of industrial modernity... p37*

The persistence of sustainability issues is further aggravated by their pervasiveness.

#### *4. Pervasiveness*

Many sustainability issues have become culturally embedded. They have become pervasive and invisible because they are culturally naturalised; ordained by a degree of cultural authority through convention, institutionalisation or mythology. Culturally embedded issues require a different approach in order to be resolved than issues that are openly acknowledged as aberrations or systemic malfunctions. If the cultural dimension is ignored, root causes of issues can be easily overlooked. The pervasiveness of the issues suggests that issues need to be addressed in a multidimensional framework that can encompass the overt and tacit socio-cultural aspects of issues. That is, the capacity of the policy framework to address naturalised, embedded aspects of the cultural episteme in which it is immersed itself needs scrutiny.

#### *5. Post-industrial modernisation in emerging nations*

The modernisation efforts of emerging nations are a major contemporary challenge that will grow into the future if a sustainability framework is not devised and utilised. Emerging nations are justified in seeking to improve wellbeing among their citizenry. However, serious sustainability issues will emerge if the non-sustainable aspects of western development are followed.

The industrialisation of Europe in the 19th century was accompanied by an interpretation of economics in which accumulation of material wealth became the objective, not the means. Overcoming scarcity was achieved by economic expansion, therefore economic expansion is the purpose of economics. However, material accumulation as a goal is an interpretation of economics described as 'chrematistics' by Aristotle (Anielski, 2000). The obverse of chrematistics is 'oeconomie', meaning 'management of the household'. It will be shown below that reclaiming economics with an oeconomie interpretation and moving away from chrematistics is an important step on the path to sustainability.

### **2.4 Implications of the imperatives for effective sustainability policy**

Voss and Kemp (Voss and Kemp, 2006) voice the frustration and dissatisfaction with the lack of effective sustainability policy so far:

*Disappointment abounds in public discourse about sustainability. Many say that the outcome of sustainability strategies has been meagre compared to the outpouring of rhetoric regarding the concept towards the end of the last century.... But when it comes to practical implementation, the concept seems to dissolve into rhetoric that masks familiar conflicts over concepts, goals and instruments that for decades have dominated societal action in problem areas such as energy, transport, agriculture and housing. p3*

The imperatives for effective sustainability policy draws into question the competence and adequacy of existing policy processes: whether conventional policy processes have the capacity to address the conditions being confronted. Grin et al. (Grin et al., 2011) p107-108 say that most persistent issues require more than current policies can deliver. However, Schön and Reid (Schön and Rein, 1994) explain that analysts are inclined to keep policy theory research separate from policy-making in practice; hence the opportunities for reflexivity, reflection and feedback that are necessary for changing policy processes are excluded.

*Reflection of a kind that might hold potential for help in the resolution of intractable policy controversies is deemed to be out of place in policy making, where it might be most fruitful, while in the academy, which is seen as its proper locus, it tends to unfold in a way that is useless to those who are engaged in policy practice. On both counts practice loses out. pxvii*

This means that critical analysis of the policy implementation processes is not part of conventional policy research: the problems are perceived to be 'out there', not within the policy domain itself.

The imperatives for effective sustainability policy suggest that the path to sustainability requires changes in the policy approach itself.

A new policy approach is needed to attend to sustainability issues because there are no fixed effective responses to complex issues; unique interpretations need to frame approaches, and adaptive responses need to be cautiously implemented. As Espinosa and Walker (Espinosa and Walker, 2011) explain

*Current attempts to create a sustainable society are clearly not working ... this is due to the continuing application of ideas and concepts which evolved in a previous age and are no longer relevant. New approaches based on ideas rooted in systems and complexity theory have a far better chance of understanding, and thus helping with the creation of, a society which has a chance of survival. p21*

## 2.5 Conclusion

Recognition of the extent, significance and persistence of contemporary issues suggests that urgent effective action is needed. These issues are not new, and despite their significance, they are not going away. The persistence and pervasiveness of the sustainability imperatives indicates that there is a gap between policy intention and the capacity of conventional policy processes to implement effective policy to ameliorate these issues. Essentially, it is not an information deficit that is inhibiting movement towards sustainability.

The pervasiveness of the issues suggests that many issues are embedded within the socio-cultural episteme that underpins modern lifestyles.

Legacy issues are unlikely to be resolved with current constructs of economic viability. A different conceptual framework is needed to frame policy so that the remediation of past actions can be incorporated into viability assessment processes that enable the necessary work to be done. At the same time, awareness of the legacy imperative provides incentives to minimise negative legacies to be passed on to future generations.

The needs and aspirations of the emerging nations imply the necessity for policy approaches that can discriminate between constructive and destructive (wasteful and exploitative) activities on the pathway to improvement and sustainability. Sustainability-informed policy options that are resource efficient and enhance genuine, durable, wellbeing are needed.

Discussion of the imperatives for effective sustainability policy has shown that deep-rooted change, rather than reform, is needed. It has also shown that the issues inhibiting change are complex and ingrained on many levels.

In the next chapter the sustainability implications of the new understandings of complexity and uncertainty are discussed.



## Chapter 3: Complexity and sustainability policy

### 3.1 Introduction

In this chapter I explain how the new understandings of complexity require that approaches to sustainability need to be reframed. The need for change arises because ongoing use of policy frameworks that misconstrue issues with outmoded methodologies, concepts and causal relations can exacerbate the issues that they are trying to remedy. Understanding complexity is necessary for understanding how sustainability issues are resilient to contemporary policy approaches.

Harris (Harris, 2007) describes the 21<sup>st</sup> century as an 'age of complexity' in which social, environmental and economic issues are intertwined and cannot be resolved independently of each other (Dovers and Handmer, 1997, Durant et al., 2004).

Globalisation, or global modernism has created an unprecedented suite of issues that are no longer localised, reversible, predictable or immediate. Asselt (Asselt, 2000) explains that:

*... [t]here are different causes for this increasing complexity: increase in scale: global and international processes increasingly interact with developments on the national and regional scale, and vice versa; technological developments; acceleration of processes, implying that turnover rates decrease. Complexity creates a new context and suite of challenges for conventional policy processes. p82*

Complex issues challenge the boundaries and perspectives of specialist disciplines, policy processes and institutional structures. They cannot be resolved with approaches that attempt to impose blueprints, fixed goals, outcomes or end points (Voss and Kemp, 2006). As Weaver and Rotmans (Weaver and Rotmans, 2006) explain:

*Complexity means that sustainability-related problems cannot be addressed adequately from a single perspective, whether this is that of one country, one culture, one ministry or one scientific discipline. p7*

The uncertainty and interconnectedness of complex issues mean that the tasks of contemporary policy makers are very different than in previous times. There are a lot of diverse aspects to consider. The aim of this chapter is to discuss the nature of

complexity and the implications for sustainability that complexity and uncertainty bring. Approaches that accommodate complexity are required so that the interactions and relations between institutions, communities and individuals can be facilitated in collaborative, adaptive and flexible relationships (Harris, 2007).

### 3.2 The nature of complexity

Complex situations exist without clear or common agreement about causes, or solutions.

Complexity describes situations in which causal relations are subtle and complex (O'Toole, 2004), non-linear, dynamic, adaptive and diffuse (Kastenberg et al., 2005). Vagueness (Kane, 1999), unpredictability (Rammel and van den Bergh, 2003) and uncertainty (Arentsen et al., Stirling, 2006, Asselt, 2000, Dovers et al., 2001a) are general attributes. It is characterised by pluralist perspectives and multidimensional causalities that have a multitude of possible responses. As Svedin (Svedin, 1991) explains

*Today it is not possible to know, at least in detail and with certainty, what happens to multi-stressed natural systems when we apply a human impact pressure of varying degrees on them. In many instances it is even very difficult to disentangle what are man-made causes from what are more natural ones.*  
p5

Complex issues manifest within a nested hierarchy of contexts, across a broad geographical scale, and within a range of time frames between action and responses that are essentially different to conventional policy frameworks.

Froger and Zyla (Froger and Zyla, 1998) explain complexity as having

*... the features of unpredictability, of emergence of new properties within the complex phenomenon. It doesn't assume a latent determinism which would allow us to predict the evolution of this phenomenon by calculation or in terms of probability...* p289

Complex issues are best understood within a systems framework in which characteristics of emergent properties, co-evolution and self-organisation can be acknowledged (Rotmans, 2006). Spangenberg explains that the dynamic non-linear characteristics of ecosystems, social and economic systems mean that "... the predictability of system behaviour is limited not only because of the current lack of



knowledge but also for fundamental reasons” (Spangenberg, 2001) p29. That is, there are different causal relations within complex systems: emerging properties or co-evolutionary dynamics mean that a situation can change dramatically as a result of slight changes elsewhere in the system (Ormerod, 1999, Embrechts, 1994, Gleick, 1988, Kiel and Elliott, 1996). Some variables may change as a result of the very act of being examined (Heisenberg, 1958). Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) explain that a different approach is required to understand the relationship between system dynamics and the constituents of that system:

*Completely understanding the constituent parts of a complex adaptive system does not allow a complete description of it because the interrelations between its parts are also deemed to have a significant effect on its overall behaviour; the progress towards sustainability in our case. Reductionist tools tend to break down the system in smaller components (e.g. energy and matter flows in biophysical metrics, human preferences in economic tools) and understand it but they do little to understand the interrelationships between these components. p248*

Kelly (Kelly, 2011) (NP) provides the example of using aggregation to explain the relationship between the drops of water in a puddle in a sink and the whirlpool that is formed when the plug is removed. There is none. The sum of the droplets does not explain what happens: his example is that  $2 + 2$  no longer equals 4; it doesn't even equal 5. Complexity means that  $2 + 2$  may equal apples! That is, aggregation cannot explain the relation between the drops of water and the formation of the whirlpool. It requires a cognitive leap and reframing of the context and approach to the issue.

There are a variety of perspectives by which complex issues can be addressed. Espinosa and Walker (Espinosa and Walker, 2011) explain that perceptions of complexity are normative in that they depend on the cognitive dispositions of the observer. The term 'variety' is used by Espinosa and Walker (Espinosa and Walker, 2011) to describe

*... a measure of perceived complexity; both in mechanical and in social systems. It refers to a repertory of potential behaviours... p12.*

Complex issues have a surprise element and may manifest in unexpected situations across unexpected time frames and geographical scales. Dynamic, adaptive and

non-linear relationships (such as feedback loops) (Loorbach and van Raak, 2005) are key characteristics of complexity.

Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) explain that the change process in complex systems is non-linear and unpredictable. This has implications for conventional analytical techniques and approaches that use relations between past and present, micro and macro and particular and general as the basis for prediction:

*During these periods of abrupt change past experience is an inadequate basis for predicting the future state of the system.... Another key characteristic of complex systems is their dynamic and non-linear nature where the existence of feedback loops renders the prediction of their future behaviour a challenging task given that small inputs can lead to disproportionately large consequences (butterfly effect)... (Gasparatos et al., 2009) p248*

Complex issues are frequently called 'wicked issues' (Conklin, 2006, Rittel and Webber, 1984) because they have no single pathways to fixed solutions. It means that amelioration of issues is an evolving process. However, 'wicked', or even 'social mess' (Horn, 2001) carries connotations of complexity as being, in some way, an aberration of a more perfect world. The danger of framing complexity in this way is that it encourages policy approaches that aim to restore lost order, or move towards a more perfect reality – i.e. overcome 'wickedness'. It is problematic because complexity is not a state of fallen grace, it requires a perception of reality devoid of ideal type abstractions. The idea of lost order is a fundamental misconception of how the world is. Hence, in this thesis, the phrase 'complex issues' is used instead of 'wicked issues'.

Complex adaptive systems are dynamic, have non-linear causal relations and do not evolve in ways that are based on precedent. As Loorbach and Rotmans (Loorbach and Rotmans, 2006) explain:

*Complex social systems are adaptive, which implies that the system as a whole adapts to its environment. But complex systems are co-evolutionary by nature as well; the dynamics at a particular systems-level are resulting from interaction between developments at lower systems'-levels. Complex systems, societal or other, thus change because of internal (often small-scale) changes out of which patterns emerge or because of external changes in the environment (landscape). This co-evolutionary, adaptive characteristic gives the system the property to self-organise.... p5*

### 3.3 Complexity and sustainability policy

The new awareness of complexity has created new challenges. The existence of a range of uncertainties predicates the need for a policy approach to complex issues; without uncertainty, there would be no need for policy.

Policy approaches that are based on eradicating or overcoming uncertainty are unlikely to succeed, or they are likely to exacerbate the issues being addressed. The sustainability policy process needs to be reflexive. To accommodate complexity and uncertainty, the policy process needs to be flexible, inclusive, adaptive and iterative. How to achieve this, while still adhering to the basic tenets of legitimacy, accountability and efficacy, is a major challenge for sustainability policy makers. As Roe (Roe, 1998) explains:

*Under conditions of uncertainty and complexity, public policy are courses of action and their revision or redirection in light of surprise, both of which are to be triangulated upon from different directions and methodologies; such policies are designed to capitalize on the various abilities and capabilities of the client, decision-makers or persons concerned and include specification of the means by which this revision and redirection is to be achieved through the use of policy-relevant research and other forms of analysis in implementation.*  
p16

The purpose of policy is to provide focus, clarification, awareness and strategies for effective action that can manage the degree of uncertainty according to the context in which the issues manifest. However, by and large, conventional policy approaches were developed from a Newtonian, mechanical epistemology and are not designed to deal with complex interrelationships and varying degrees of uncertainty.

Since the emergence of neoclassical economics in the 1870s and the Bayesian approach to probability in the 1950s, there have been substantial advances in understandings of cognition, methodology, ontology and epistemology. These include complexity theory (Manson, 2001), chaos theory (Gleick, 1988, Kiel and Elliott, 1996) and systems theory (De Greene, 1993a). Each of these has facilitated

new and richer understandings of the intricacy and intertwinedness of world than was previously thought<sup>15</sup>.

The metaphor of the 'butterfly effect' (Ormerod, 1999) or 'extreme sensitivity to initial conditions' challenged the mechanistic universe of Newton (Burt, 1932). A new conceptual and analytical framework in which these cognitive, epistemic and other changes can be integrated into an effective sustainability policy process is required.

Addressing complex issues requires a policy approach based on transdisciplinary perspectives to investigate the potential need for change across multiple dimensions. Durant (Durant et al., 2004) states that such issues cannot be addressed by the governance regimes that helped create the issues:

*... Nor do they see purely market-based, government-based, or community-based solutions as up to the task of addressing today's and tomorrow's environmental governance challenges. p2*

Norgaard (Norgaard, 1988) explains that policy and hermeneutic approaches are necessary for sustainability:

*... the policy process will enter the realm of the hermeneutic where there is no prior agreement on the key questions, appropriate framework or essential facts. With an expansion of worldviews and a broader conception of knowledge, we will find little consensus on questions, methodologies and data for determining optima. Good policymakers will be those who can lead enlightening conversations between scientists with different disciplinary backgrounds and between people of different cultures and knowledges. Quoted in (Frame and O'Connor, 2011) Pp1-2*

Funtowicz (Funtowicz et al., 2002) p53 suggests that the need for changes in policy approaches arise because previous initiatives that used simplistic approaches have not been successful with complex issues. Consequently, as Asselt (Asselt, 2000) states, policy makers have to shift

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15 See ROE, E. (1998) *Taking complexity seriously : policy analysis, triangulation and sustainable development*, Boston, Kluwer Academic, BERTUGLIA, C. S. & VAIO, F. (2005) *Nonlinearity, chaos, and complexity : the dynamics of natural and social systems*, Oxford ; New York, Oxford University Press, HARRIS, G. P. (2007) *Seeking sustainability in an age of complexity*, Cambridge, Cambridge University Press, LOORBACH, D. & VAN RAAK, R. (2005) *Governance in Complexity: A multi-level policy framework based on complex systems thinking. Lof der Verwarring*. Engels, Rotterdam, Dutch Research Institute for Transitions, MANSON, S. M. (2001) *Simplifying Complexity: a review of complexity theory. Geoforum*, 32, 405-414.

*... from analysing the impact of uncertainty on the conclusions to treating uncertainty as intrinsic and key facet of the issue under concern. Uncertainty should not longer be treated as marginal issue or a closing entry in the analysis, but it should be at the heart of the assessment. p108*

Roe's (Roe, 1998) perspective is that analysis of contemporary issues within a complexity framework is the most viable means of moving towards understanding:

*Issues of extreme uncertainty and complexity can be analyzed quite effectively without falling back to inspiration alone. The analytic methods required for these sometimes desperate situations are, however, not those taught in most of our methods courses and seminars. Yet we proceed ahead today as if the old methods will get us across this complex public policy terrain. When those peter out, we seek inspiration, a.k.a. luck, leadership, intuition, or the high octane of political will, to propel us the rest of the journey. What we missed before starting are those fairly recent developments in analytic methods that could fuel us farther, more reliably. p4*

Attending to complex issues requires policymakers to make a subtle but significant shift from making decisions by resolving uncertainties toward managing according to the quality and degree of uncertainty that characterises the issue. As Harris (Harris, 2007) states:

*The question is: instead of security and domination, can we find a new resilience in the face of global constraints, and of complexity, change and variability? To do so will require a new approach to complexity and change and a new view of the interactions and relationships between individuals, communities and institutions that allows of greater flexibility, adaptiveness and collaboration. p19*

The perception of complexity depends on the awareness that the agent addressing the issues<sup>16</sup> has of the new understandings of complex issues.

### **3.3.1 Managing with complexity and uncertainty**

The need to make decisions about complex issues in conditions of uncertainty suggests that a wider range of policy approaches is needed. Analysis of complexity suggest that using a single methodological framework or monodisciplinary approach to complex issues limits the possible interpretations of those issues and

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<sup>16</sup> "The experience of revelation, whenever it occurs, is invariably a process of self discovery, when a passage of a book or lecture triggers off conscious recognition of something we half understood already. We are conditioned to attribute this process to the author or lecturer, but the relationship of this sense of enlightenment to the immediate experience is often at best contingent. The intellectuals would like us to believe that ideas govern life and that the rest of humanity consequently should take our lead from them, but it is the other way round, on both counts". HART, K. (2001) *Money in an unequal world : Keith Hart and his memory bank*, New York ; London, Texere. p21

enhances the likelihood of malframing policy approaches<sup>17</sup>. As Kane (Kane, 1999) explains:

*...we can hardly afford to continue with the current experiment which looks at just how far we can push the earth's systems before we irrevocably ruin the planet. We need common sense efforts at making progress and we need to redefine what we consider to be real 'progress'. It must be measured considering all the layers of sustainability discussed above, not just economic layers. p28*

According to Arentsen, Bressers and O'Toole (Arentsen et al., 2000), managing complexity and the accompanying uncertainty for sustainability has two main aspects:

1. Uncertainty of problem definition (or ways to frame the issues). This aspect may be a legacy of complexity, or of 'normative confusion'. Arentsen, Bressers and O'Toole (Arentsen et al., 2000) give the example of deciding the extent to which a problem for future generations needs to be addressed in the current generation. This is described in the imperatives for effective sustainability policy as the Legacy issue; and it incorporated in the sustainability principle of intergenerational equity.
2. Uncertainty of policy response. This may result from complexity, or from inability to effectively implement appropriate policies. Arentsen argues that sustainability is already feasible in technical, economic, behavioural and political perspectives. These uncertainties are not 'empirical information gaps' but situations that require ongoing learning (Arentsen et al., 2000) to facilitate effective sustainability policy. This capacity for on-going learning needs to be incorporated into all phases of the policy process. Complexity requires the approaches to issues to be constantly re-evaluated and adapted accordingly, including the analytical methodologies used in the development of policy strategies.

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<sup>17</sup> "... today's analytic challenge is to avoid deluding ourselves into believing that the best way to adapt to complexity is through thinking only in linear, tightly coupled terms. The linearity of regression analysis, the tight coupling of benefit streams in cost-benefit analysis, even the "basic regularities" that are said to drive Complexity or Chaos Theory ... are supreme examples [of this tight coupling]." ROE, E. (1998) *Taking complexity seriously : policy analysis, triangulation and sustainable development*, Boston, Kluwer Academic. p5

However, as Loorbach and Rotmans (Loorbach and Rotmans, 2006) explain, there are aspects of complex systems, such as the propensity for self-organisation that provide hints as to how complex issues may be managed:

*In complex adaptive societal systems there is no external control over the system. Moreover, it can be argued that every directed action of any kind by any agent can be considered as 'managing' some (sub) part of the system. Management is then inherently part of the system and can even be regarded as a complex system itself ... p5*

### **3.3.2 Sustainability, complexity and science**

A problem for sustainability policy is the tendency for decisions to be made from reductionist science conclusions. Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) argue that reductionist methodologies are inadequate for dealing with complex issues in a holistic manner:

*Tools and methodologies based on the reductionist paradigm have been used over the past years to measure the progress towards sustainability but very few of them seem to be able at the moment to assess sustainability in a holistic manner.... p246*

Rotmans (Rotmans, 2006) explains that conventional science has failed to develop adequate tools to accommodate the complexity of sustainability issues. Decisions have to be made on what is perceived as a rational basis and expertise. However, the processes of establishing the pertinent facts, or even demonstrating what is meant by a 'fact' (Poovey, 1998) are themselves questions that need to be addressed when dealing with complexity. Such questions are beyond the scope of reductionist science. As Asselt (Asselt, 2000) explains:

*The role ascribed to science as the "provider of certainty" is deeply influenced by the epistemology ... of what is known as the Enlightenment or the Age of Reason. Enlightenment thinking grew into what is generally referred to as 'positivism'. Positivism can be defined as the search for, and prediction of, empirical regularities to make universal, true statements. The quantitative method of natural science is the adopted approach to gather objective knowledge. In the positivist epistemology, uncertainty is considered as something unscientific. ... These positivist absolutisms have dominated science far into the 20th century. p78*

The dilemma is that decision makers want certainty that cannot be provided. Asselt suggests that scientific integrity is undermined because science is being asked to provide a degree of certainty about issues that is beyond the capacity of its

methodologies, and for which it was not designed (Asselt, 2000). Complex issues such as climate change and species' extinctions are leading more scientists to try to convince policymakers that certainty is no longer an attainable precondition for decision-making (Modvar and Gallopin, 2005). A major challenge for these scientists is how to convey the limitations and qualifications of post-normal science when dealing with complex issues (Gasparatos et al., 2009). The paradox is that uncertain science appears weak and a legacy of incompetent methods, when it is actually derived from a higher form of legitimacy. Asselt (Asselt, 2000) explains that there is no tool-kit to adequately address technical, methodological or epistemological uncertainties and suggests that 'uncertainty management' be developed as a discipline, based on a change in the role of science from a 'search process that yields insights', to a *puzzling* approach that yields insights (Asselt, 2000).

Meppem (Meppem, 2000) and others explain that contemporary political institutions are not geared for managing complexity: they are more or less judged by their capacity to resolve well-defined problems framed by simple clear goals. As a consequence, implementation of effective policy is thwarted by the processes and structures charged with managing the issues.

Accommodating complexity does not eradicate the need for specialist disciplines, but it does suggest that their use needs to be tempered with collaboration and broadened approaches (Stirling, 2006). Modvar and Gallopin (Modvar and Gallopin, 2005) explain that:

*... an engineering approach to sustainability seeking to anticipate all critical situations and building the "perfect model" may not only be doomed to fail, but it could also be exceedingly dangerous for human civilization. The scientific quest for even better understanding and predictive capacity must be complemented by new research and priority-setting strategies that do not merely recognize uncertainty, but even embrace it, becoming part of the process of change as well as probing its transformation possibilities. p28*

The next section describes how conventional responses to complex issues are constructed so as to avoid changes being made to the policy process or underlying epistemology of the contemporary paradigm in which policy is framed.



### 3.3.3 Conventional responses for managing uncertainty

A common response to complexity is to use methodologies that feign certainty. Simplistic approaches, framed with facile concepts of sustainability, and highly abstract ideal-type analysis are used to address complex issues. These approaches tacitly assume away key aspects of complexity that are creating the issues that need to be addressed.

On one level it is reasonable, practical behaviour: Politicians are keen to get 'numbers' to justify their decisions, and business people want 'certainty' (Porter, 1995) to assess their investment options. However, specific answers cannot be provided to complex issues so policymakers and analysts opt for calculations of risk or likelihood derived from Bayesian probability techniques that are based on considerations of experience and belief. The risk assessment methodologies frame complex issues with a dualistic concept of risk and uncertainty: risk is calculable – as in tossing a coin – and uncertainty is calculated in terms of percentage of likelihood. That is, the full implications of complexity in terms of degrees and types of uncertainty are ignored. As Thiele (Thiele, 2000) explains:

*Currently, risk assessment and risk management operate within a culture driven by technological, economic, and political forces that are seldom environmentally benign. The imperative of technology might be summarized by the dictum: "If we can do it, we should do it." Economic practices are grounded in business efforts to maximize profits and in the marketing logic that supply creates demand. Politics, notwithstanding its enduring ideals, often reduces itself to a pandering to the powerful. These technological, economic, and political forces form a dangerous liaison. The politicians, ultimately responsible for managing the environmental risks we face, often follow the path of least resistance laid out by business interests that, now more than ever, find their profit margins widened by technological innovation and the stimulation of mass consumption. Operating together in advanced industrial nations, these technological, economic, and political forces degrade natural habitats, pollute air, land, and water, create toxic waste, deplete natural resources, and overproduce synthetic goods and chemically altered foodstuffs. In short, this coalition of forces produces most of the anthropogenic, involuntary environmental risks that we currently face. p543*

The legitimacy of probability as a conceptual tool for analysing complexity is very relevant for sustainability policy because "...neither objective theories nor subjective theories are applicable to irreversible events" (Froger and Zyla, 1998). However, many sustainability issues are about the irreversibility of living systems,

species extinctions and resource exhaustion (Froger and Zyla, 1998). Therefore, because the Bayesian-based theories for dealing with uncertainty are not applicable when issues are irreversible, it follows that probability-based calculations from a partial part of the spectrum of uncertainties is inappropriate for sustainability policy. As Froger and Zyla (Froger and Zyla, 1998) state:

*The concept of probability is inappropriate because we are not dealing with a stationary state being discovered; rather the ecological-social-economic histories are being made-and-understood-in-time. ... ..strong uncertainty and irreversibility cannot be captured in existing probabilistic environmental decision-making approaches based on Bayesian theory's teachings and relying on a substantive rationality criterion<sup>18</sup>. p285*

He points out that the instigator of modern Bayesian theory, De Finetti, based his approach on the notion that decision makers can always represent their beliefs by a “unique probability measure that complies with Bayesian axioms” (Froger and Zyla, 1998) p483n. These assumptions were made in 1937, well before the arrival of complexity theory, the new understandings of the spectrum of uncertainty, and many other scientific advances. The way in which Bayesian belief-based likelihood surreptitiously replaced frequentist perspectives in the 20<sup>th</sup> century is little acknowledged in the general narrative about probability and risk. Since 1954, Bayesian theory has been regarded as being adequate for dealing with uncertainty (Froger and Zyla, 1998) p282.

Neoclassical economists do not extend analysis beyond questions of risk and uncertainty (Froger and Zyla, 1998). Garnaut (Garnaut, 2008), for instance, uses a singular and truncated spectrum to describe risk and uncertainty as a basis for his economics of climate change (Figure 3.1). He takes a dualistic approach to in which: “... risk and uncertainty are the extreme ends of a single spectrum.” p8

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18 “...probabilistic environmental decision-making approaches relying on Bayesian theory are based on a version of substantive rationality which cannot be applied whenever uncertainty is strong (indeterminacy) and time is relevant (irreversibility).... the probabilistic approach assumes that one unique, additive and reliable probability distribution of future environmental damages is known or knowable. The attempts to apply Bayesian theory to learning, which is a crucial dimension in environmental economics, are not fully convincing.” FROGER, G. & ZYLA, E. (1998) Towards a Decision-Making Framework to Address Sustainable Development Issues. IN O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (Eds.) *Sustainable development : concepts, rationalities, and strategies*. Dordrecht ; Boston, Kluwer. P284.

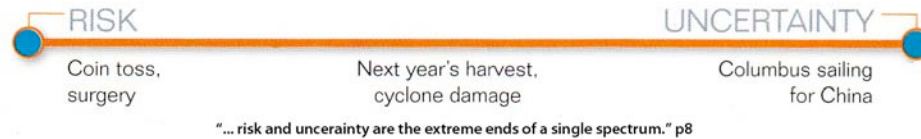


Figure 3.1 The risk-uncertainty spectrum as interpreted by Garnaut (Garnaut, 2008) p8.

Garnaut's choice of risk and uncertainty is based on the interpretation in which:

- uncertainty is basically a lack of human knowledge, resolvable through education or more information
- probability can be defined in principle, even if not in practice
- "...the possibility of complete specification never arises" (Froger and Zyla, 1998) p286<sup>19</sup>, therefore, one needs to be practical and simplify complexity into manageable parts.

However, complexity is more accurately described with a spectrum of uncertainties.

As Arentsen (Arentsen et al., 2000) explains:

*... uncertainties involve more than empirical information gaps. There is also normative confusion. In regard to problem definition, this may increase the divergence of problem perceptions (e.g., to what extent should a problem for future generations be a problem for us now?). Policy responses, even more clearly, carry normative implications... These uncertainties of problem definition and policy response are ubiquitous. p53*

Following Stirling (Stirling, 2006), Froger and Zyla (Froger and Zyla, 1998), Dovers (Dovers et al., 2001b) and Smithson (Smithson, 1988), I have conceptualised the various aspects of uncertainty arising from complexity as a *spectrum of*

<sup>19</sup> As Froger Ibid. explains, incertitude or "strong uncertainty and irreversibility cannot be captured in existing approaches based on Bayesian theory that rely on substantive rationality criteria." A Bayesian probability is belief-based and thus inherently subjective. It can "always be formulated as an equivalent of some 'bet' on a certain event" FROGER, G. & ZYLA, E. (1998) Towards a Decision-Making Framework to Address Sustainable Development Issues. IN O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (Eds.) *Sustainable development : concepts, rationalities, and strategies*. Dordrecht ; Boston, Kluwer.. This is problematic because the quantification of the 'bet' can portray an unsubstantiable probability – because of the 'superior' validity given to numbers – but also because, as part of the Bayesian approach, it is likely that the beliefs of the decision-maker are not adequately expressed "simply through a sufficiently reliable, unique, additive probability distribution" FROGER, G. & ZYLA, E. (1998) Towards a Decision-Making Framework to Address Sustainable Development Issues. IN O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (Eds.) *Sustainable development : concepts, rationalities, and strategies*. Dordrecht ; Boston, Kluwer.. P280

*uncertainties* to illustrate the way neoclassical economic analysis is framed on a partial perspective.



Figure 3.2: Neoclassical economists' perspective of complexity in relation to sustainability-informed interpretation (Adapted from (Garnaut, 2008) p8).

The spectrum of uncertainties (Figure 3.2) consists of five bands, or degrees of uncertainty: risk, uncertainty, incertitude, ambiguity, and ignorance:

- **Risk**  
Froger and Zyla (Froger and Zyla, 1998) explain risk as a situation in which probability distributions exist, “based on reliable classification of possible events”<sup>20</sup>
- **Uncertainty**  
Froger and Zyla (Froger and Zyla, 1998) explain uncertainty as events that have non-definable probability distributions. That is, some but not all outcomes are known, but further information may clarify likelihood possible outcomes. Uncertainty is characterised by unreliable probability distributions, not necessarily the absence of a probability distribution (Froger and Zyla, 1998).
- **Incetitude**  
Incetitude occurs where outcomes are not known, or knowable; irreducible uncertainty that is no longer merely an information deficit. Froger and Zyla (Froger and Zyla, 1998) suggest

<sup>20</sup> “In the first half of the nineteenth century, risk could be interpreted as the temptation that lures the overreacher to sin partly because of the unlimited liability written into company law. When every individual who owned shares in a company was liable for the company's losses to the full extent of his estate, a company's collapse exacted from partners and shareholders alike a punishment that seemed to fit the crime. Like bills of exchange, which spread fiscal responsibility for debts incurred to those who accepted the bills as well as those who passed them, company law spread fiscal responsibility for failed enterprises to everyone who once stood to benefit from success.” POOVEY, M. (2001) For everything else, there's ... *Social Research*, 68. p408

unpredictability, structural uncertainty and indeterminacy as key attributes of incertitude.

- **Ambiguity**

Ambiguity describes situations where outcomes may be known but they are conflictual rather than consistent. This occurs when non-linear causalities create divergent outcomes. Ambiguity is problematic for the credibility of science in the broader community because, without an awareness of complexity, the fact that different scientists can draw different conclusions from the same research data is confusing. It creates the sense that scientists don't know what they are talking about and diminishes the standing of scientific information in the broader community. As van Asselt (Asselt, 2000) says, scientific integrity is being undermined because science is being asked to provide results that are beyond its capacities.

- **Ignorance**

Ignorance is not so much lack of information or cognitive capacity as a condition in which we don't know that we don't know<sup>21</sup>.

Stirling (Stirling, 2006) explains:

*... ignorance represents our uncertainty about our uncertainty  
.... It is an acknowledgement of the importance of the element  
of 'surprise'.... This emerges not just from the actuality of  
unexpected events, but from their very possibility ... It is a  
predicament that intensifies directly in relation to the social and  
political stakes that bear on a particular decision ... It emerges  
especially in complex and dynamic environments in which  
social agents and their cognitive and institutional commitments  
may recursively influence supposedly exogenous 'events' ...  
p244*

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21 "Put at its simplest, ignorance is a reflection of the degree to which 'we don't know what we don't know'." WYNN, B. (1992) Uncertainty and environmental learning: reconceiving science and policy in the preventive paradigm. *Global Environmental Change*, 111-127. cited in STIRLING, A. (2006) Precaution, foresight and sustainability: reflection and reflexivity in the governance of science and technology. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar. p243

Asselt (Asselt, 2000) represents uncertainty as concentric circles of (from the centre out) technical uncertainties, methodological uncertainties and epistemological uncertainties.

Pollock (Pollock, 2004) suggests the concept of ‘procedural epistemic justification’ helps explain the reluctance to move away from an existing paradigm. It describes how beliefs are justified provided they have been arrived at in the correct way:

*Procedural epistemic justification is closely connected to rationality. We can distinguish, at least loosely, between epistemic cognition, which is cognition about what to believe, and practical cognition, which is cognition about what to do... Epistemic justification pertains instead to beliefs — the products of acts of believing. But there seems to be a tight connection. As a first approximation we might say that a belief is justified iff it is rational for the cognizer to believe it. Similarly, practical cognition issues in decisions, and we can say that a decision is justified iff it is the product of rational practical cognition<sup>22</sup>. p3*

In practice, a lack of reflexivity and awareness of complexity means that analysts and policymakers do not draw distinctions between complicated and complex systems: complicated issues are problems that have solutions; when policy makers do not employ the ‘newly enriched appreciations of the depth and diversity of different forms of incertitude’ (Stirling, 2006) p231. The problem is that complex issues are approached as if they were merely complicated because that is what the policy process is capable of handling. This results in malframed and ineffective policy, but it also is destructive of public confidence in scientific analysis.

### 3.4 Conclusion

The extent, significance and persistence of the imperatives for effective sustainability policy suggest that new understandings of complexity and uncertainty need to be included in analytical frameworks.

Decisions about complex issues cannot be made with certainty. Complexity awareness heightens the importance of understanding the spectrum of uncertainties that policy makers have to consider. To persist with facile approaches to complex issues – what Stirling describes as ‘naive realism’ (Stirling, 2006) (p247)

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<sup>22</sup> ‘Iff’ is mathematical shorthand for ‘if and only if’.

– and adopt simplistic approaches to uncertainty results in the misconception of issues and malframing of policy, and this leads to ineffective policy outcomes.

A framework that accommodates complexity and the spectrum of uncertainties is needed.

The multidimensionality of complex issues, and the pluralism of perspectives by which complex issues can be addressed, means that an overarching framework that can accommodate these aspects is needed.

In the next chapter various aspects of the concept of sustainability are discussed.





## Chapter 4: Sustainability: conceptualising its emergence and conceptualising change

### 4.1 Introduction

In this chapter I discuss the concept of sustainability so that the rationale for changes proposed later in the thesis are properly contextualised.

Sustainability evolved from the notion of sustainable development (Brundtland and World Commission on Environment and Development., 1990) into an overarching policy concept (Dovers, 2005a) as a way of accommodating the new understandings of complexity (Harris, 2007) and uncertainty (Stirling, 2006, Asselt, 2000) that characterise many contemporary issues (Meadows et al., 1992). Sustainability issues arise as unintended consequences from modernist lifestyles, and manifest as global issues such as climate change, environmental degradation, species extinctions, wasteful production, over-consumption, or poverty, dispossession and hunger. As Pahl-Wostl et al. (Pahl-Wostl et al., 2008) suggest:

*The problem that we face when we deal with sustainability lies not so much in our lack of understanding of the functioning of ecological systems, but in our lack of understanding of the governance and cultural systems and how they are structured and managed and interact with ecological systems, and how we produce science and knowledge for policy. NP*

In broad terms, sustainability is taken to refer to the capacity of a system to endure and maintain capacity for self-regeneration<sup>23</sup>. Sustainability policy refers to the processes and outputs of institutional actors aiming to enable sustainability.

Sustainability spans a range of worldviews that describe the relationship between humans and the socio-cultural and biophysical world in which they live. Clark (Clark, 2002) explains that worldviews arise from and are enmeshed in beliefs and assumptions of society. Worldviews create cultural meaning that is encased in the

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<sup>23</sup> “Sustainability in a systemic and evolutionary perspective is the ability to absorb disturbance and to reorganise, self-regulate and evolve. Whereas the capacity to absorb disturbances clearly relates to the carrying capacity concept, the reorganisation, self-regulation and evolution principles relate to change and more importantly to the diversity aspects of systems that enable them to adapt to change and survive. Sustaining a system's capacity to survive clearly means in this respect that diversity is of indispensable value and a constitutional parameter of sustainability.” KOHN, J., GOWDY, J. M., HINTERBERGER, F. & VAN DER STRAATEN, J. (1999a) The Imperative of Sustainability: Introduction. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar. p6

language, shared values and traditions and conveyed by narratives, metaphors, fables and myths. According to Tàbara and Pahl-Wostl (Tàbara and Pahl-Wostl, 2007),

*...one of the main reasons that there are so many definitions of sustainability must be found in the way that different cultural world views conceive the relationships between humans and natural systems. NP*

Sustainability is a multi-faceted and contested concept<sup>24</sup>. This chapter aims to explain the different aspects of sustainability, a set of generally accepted sustainability principles and the challenges that sustainability poses to policymaking.

## 4.2 Sustainability as concept

### 4.2.1 The concept of concept

Kim (Kim, 1994) P41 describes a concept as "... a systematically arranged perception of the mind." Hampton (Hampton, 1999) explains concepts as being

*... embedded in theoretical understanding of the world. [They are] the elements from which propositional thought is constructed, thus providing a means of understanding the world. ... [C]oncepts are used to interpret our current experience by classifying it as being of a particular kind, and hence relating it to prior knowledge. The concept of "concept" is central to many of the cognitive sciences. p176*

Wray (Wray, 2007a) explains that concepts:

*... help to integrate apparently unrelated observations and phenomena into viable hypothesis and theories... The concept map is used to help researchers visualize the inter-relationships between various concepts. p611*

Concepts can be regarded as a mental construct, but some consider them to be real things. These two perspectives on the reality and use of concepts are particularly relevant when discussing the relationship between sustainability and neoclassical

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24 'Most books on sustainability address... the question of what sustainability 'really is'. The authors of those books imply, implicitly or explicitly, that there is a possible state of affairs called 'sustainable living' that can be discovered and given a linguistic label. The work is in finding this state of affairs; labeling it as sustainability is the relatively passive act of applying a label to a preexisting concept. ... Unlike dualistic theories that assume there is a reality, preexisting, to which we, as mentally active beings, attach labels, my approach to language assumes that linguistic acts are as important in constituting entities and relationships as are the objects of our experience. ... Defining a contested concept like sustainability, then, must involve a construction.' NORTON, B. G. (2005) *Sustainability : a philosophy of adaptive ecosystem management*, Chicago, University of Chicago Press. p446

economics. Neoclassical economics is based on the Platonic perspective which, in general terms, may be described thus:

*Plato was the starkest proponent of the realist thesis of universal concepts. By his view, concepts (and ideas in general) are innate ideas that were instantiations of a transcendental world of pure forms that laid behind the veil of the physical world. (Wikipedia) NP*

The different notions of concepts are reflected in the diverse ways issues are approached and analysed. The point of difference is whether concepts are created by the mind as a tool for understanding the world around us, or whether abstractions already exist as underlying invisible entities that need to be discovered so we can understand the world around us.

Sustainability is a conceptual abstraction rather than an abstract representation of a pre-existing definable state (Norton, 2005) p446. It is a concept that incorporates futurity, reflexivity, transdisciplinarity, precaution, participation, social learning and adaptation. Gibson (Gibson and Hassan, 2005) provides a comprehensive summary of various conceptualisations of sustainability, beginning with the Stockholm conference in 1972 through to the Millenium Ecosystems approach in 2005, describing each interpretation in terms of components, principles and core objectives.

Sustainability is complex, normative, and evolving<sup>25</sup>. It is related to, but different from environmentalism<sup>26</sup>. Dovers and Handmer (Dovers and Handmer, 1997) describe sustainability as an “umbrella concept beneath which integration of the myriad interrelated issues of environment and human development can occur” p1.

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25 “The term sustainability has evolved over the years as we have learned more and more about the complexities of the social, economic and biological worlds.” KOHN, J., GOWDY, J. M., HINTERBERGER, F. & VAN DER STRAATEN, J. (1999b) Sustainability in Question: Preface. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar. pxv

26 “... sustainability is not environmentalism dressed up for the new millennium but is essentially a new way of seeing the world ....” SPANGENBERG, J. H. (2001) Sustainable development : from catchwords to benchmarks and operational concepts. IN CHARTER, M. & TISCHNER, U. (Eds.) *Solutions: Developing Products and Services for the Future*. Sheffield, Greenleaf. p27. “...sustainability does not belong exclusively to the realm of policy-environment interactions.” KOHN, J., GOWDY, J. M., HINTERBERGER, F. & VAN DER STRAATEN, J. (1999b) Sustainability in Question: Preface. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar. pxv

#### 4.2.2 Sustainability as a contested concept

There are many studies that describe sustainability as an ambiguous and contested concept (Bressers and Rosenbaum, 2003, Jacobs, 1999). Meadows (Meadows et al., 1992) wrote in 1994 that

*... world society is still trying to comprehend the concept of sustainability, a term that remains ambiguous and widely abused even sixteen years after the Brundtland Commission coined it. p xv*

Sustainability is often criticised as being too vague, normative, complex and not sufficiently operational for practical purposes<sup>27</sup>. Costanza (Costanza, 2001) writes:

*Critics argue that the concept of sustainability is useless because it cannot be adequately defined. Much of this discussion is misdirected because critics (1) fail to take into account the range of time and space scales over which the concept must apply; and (2) fail to realise that the real problems are related to prediction rather than definition. p6*

However, arguing that a specific definition of sustainability is required is based on rigid conceptualisations that are not as relevant for sustainability issues. Weaver and Rotmans (Weaver and Rotmans, 2006) explain that

*... it is useless to try to develop a 'generic' definition of sustainable development in a quasi-objective manner. Rather it is better to seek a context-specific interpretation of sustainability that is acceptable to a wide range of stakeholders within a particular application domain. p7*

Moving beyond the contested definition of sustainability issue creates scope for interpretations of sustainability that are informed by complexity and transdisciplinary perspectives to frame approaches to contemporary issues<sup>28</sup>.

The problems with defining sustainability can be distilled into three solutions:

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27 "Like most subsequent efforts to characterize the idea of sustainability the implications [of the Brundtland definition] are conceptually ambiguous. The predictable result has been intense debate whenever the topic of sustainable development is discussed about practically every aspect of its implications for public policies." BRESSERS, H. & ROSENBAUM, W. A. (2003) Social Scales, Sustainability and Governance: An Introduction. IN ROSENBAUM, W. A. & BRESSERS, H. (Eds.) *Achieving sustainable development : the challenge of governance across social scales*. Westport, Conn., Praeger. p5

28 "The emergence of sustainability interpretation as an issue – and the difficulties it entails – has paralleled an easier process through which unsustainable trends have been identified. Sets of critical 'unsustainabilities' and trends incompatible with sustainability have been identified at different spatial scales from the global downward: one obvious illustration is the threat of global climate change." WEAVER, P. M. & ROTMANS, J. (2006) *Integrated Sustainability Assessment: What? Why? How? Methods and Tools for Integrated Sustainability Assessment (Matisse Working Papers)*. Rotterdam, The Netherlands, DRIFT. p10

### 1. Sustainability as higher-order phenomenon

Dovers (Dovers, 2003b) suggests that sustainability is “... best thought of as a higher order social goal, akin to similar social goals such as democracy, equity or the rule of law...” p2

Richardson and Wood (Richardson and Wood, 2006a) suggest treating sustainability as a “social goal or fundamental property of natural or humans systems” p13, such as art, democracy, and freedom. In this sense, sustainability is an aspirational concept that creates a challenge for humanity to put into practice as a way-of-being.

### 2. Sustainability as Interpretation

According to Weaver and Rotmans (Weaver and Rotmans, 2006), the need for interpretation is an “... inevitable aspect of the contingency of the sustainability concept, which arises from its systemic character” p7. An interpretative approach allows adaptive changes to be made as new information and awareness emerges. As Weaver and Rotmans (Weaver and Rotmans, 2006) write:

*...any sustainability ‘interpretation’ cannot be confined only to matters of substance, such as which economic, social and environmental values are relevant to sustainability, but must also include principles, such as the protection of critical values (related to perspectives of people), and rules that define how trade-offs between values that in principle are negotiable are to be made... p8*

Early representations of sustainable development were based on triple bottom line accounting, and portrayed in the Venn diagram as intersections of overlaid economic, social and environmental domains. In this portrayal, sustainable development is “... depicted as expansion of the area where circles of social, economic and ecological quality overlapped” (Kemp et al., 2005) p15.

However, the framing of issues in this manner denies the dynamic realities of the biophysical context in which economic activity occurs, and on which it is dependent. This way of framing issues still underpins many approaches, including the Australian Bureau of Statistics (See Figure 4.1).

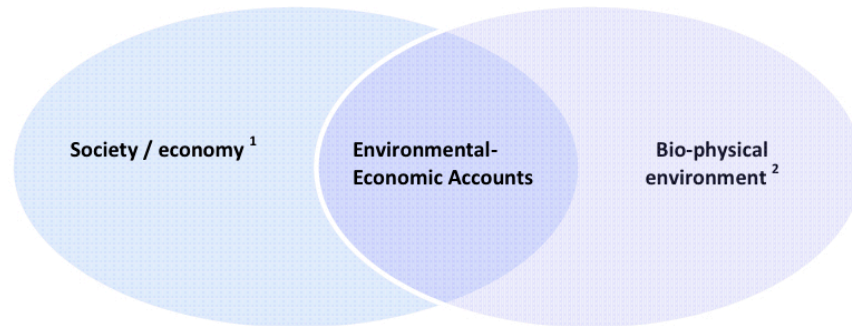


Figure 4.1 ABS diagram showing their approach to integration of information systems

(Australian Bureau of Statistics, 2009) p7

It is difficult for this author to comprehend how activities in the society or economy domain can be thought to exist outside the biophysical environment. It is as if policymakers think that the environment exists outside and independent of the human and social domains, and can be analysed *as if* this is the case (See Figure 4.2).



Figure 4.2 Kudelka Cartoon expressing the exclusion of the environment from social and economic domains

(Kudelka, 2008), The Australian, 16/7/2008

The Australian Bureau of Statistics (ABS) uses the Venn diagram approach to frame their analysis as a ‘two pillar’ relationship (Australian Bureau of Statistics, 2009).

The two pillars are integrated so that:

*... biophysical and socio-economic dimensions of environmental issues can be considered concurrently in policy formulation and other decision making ...by the use of common frameworks, classifications and standards. ...The information in each pillar should be organised so that, for the environmental domain of interest, users could seamlessly move from the bio-physical aspects to the socio-economic aspects and vice versa. (Australian Bureau of Statistics, 2009) p7*

This methodological aim of 'seamless' movement between pillars is obtained by over-riding the basic tenets of biological diversity and biophysical reality. The interaction between the two pillars is framed in a driver-pressure-state-impact-responses framework "... built around the various environmental domains (e.g. water, air, land)" (Australian Bureau of Statistics, 2009) p7. It is a curious conceptualisation to regard water, air and land as separate domains: it ignores, for instance, the hydrological cycle and the interrelationships of the web of life taught in high school biology (Strauss and Lisowski, 2000). It reflects the basic assumption of substitutability to create a 'common' framework.

Kemp, Parto and Gibson (Kemp et al., 2005) suggest that the Venn diagram approach was useful at the time:

*These depictions were useful in stressing the links among desirable social, economic and ecological qualities and in indicating that much of our current activity lay outside the realm of potential sustainability. However, even where the roles of social and ecological as well as economic factors were respected, the tendency to consider them separately proved hard to overcome. p15*

That is, more contemporary understandings of complexity and system dynamics show this Venn approach to be simplistic. The common portrayal of sustainability as a Venn diagrams results in sustainability being regarded as part of a triple bottom line, but ultimately non-economic aspects are treated as an appendage to the corporate or national accounts in this approach. The bottom line remains an economic-framed reality so that how much sustainability can be efficiently afforded is determined by economic considerations.

### *3. Sustainability as a Pathway*

Rammel and van den Bergh (Rammel and van den Bergh, 2003) conceptualise sustainability as a 'pathway', which involves a continuously pursued direction (Bressers and Rosenbaum, 2000). The pathway is a transition process that begins

from where you are – for example, by developing one’s ‘sense of place’ (Seddon, 1972) – and framing issues there from. The pathways approach involves a movement “... away from reactive, incremental policy making towards anticipatory, integrated approaches” (Brady, 2005) p402. A pathways approach helps avoid the predicament of ‘lock-in’ (Rammel and van den Bergh, 2003) that occurs when fixed solution-oriented approaches are used to address dynamic complex issues.

In this interpretation, broad sustainability parameters, principles and practices are used to define the pathway to sustainability. For instance, Spangenberg (Spangenberg, 2001) suggests eco-efficiency or reduced resource consumption as appropriate goals. This encompasses strategies that facilitate recycling, waste minimisation, energy and water efficiency, etc. Other broad goals include housing design, planning of cities and communities, preservation of habitat, protection of flora and fauna in national parks and marine protected areas, transport design, emission controls, etc. Transition management (Kemp and Loorbach, 2006, Rotmans et al., 2001, Sondejker et al., 2006) can be used to create scenarios and transition arenas that guide the pathways approach.

#### **4.2.3 Sustainability as an evolving concept: from sustainable development to sustainability**

Sustainability is evolving conceptually from the notion of ‘sustainable development’ as promulgated in the Brundtland report (Brundtland and World Commission on Environment and Development., 1990). This report was a watershed for public policy, but the central focus on sustainable development gave the concept an economic bias. Kane (Kane, 1999) and Kohn (Kohn, 1999a) explain how sustainability continues to evolve with the increased awareness of social, cultural, economic and biological complexity and interconnectedness that arose in the last part of the 20<sup>th</sup> century (Kohn et al., 1999b, Roe, 1998, Bertuglia and Vaio, 2005, Harris, 2007, Loorbach and van Raak, 2005, McDonald, 2009).

Use of the term ‘sustainability’ enables a shift in emphasis to be made away from economic growth to a broader systemic understanding of endurability within a



system across scales and dimensions. Richardson and Wood (Richardson and Wood, 2006a) suggest that

*... some commentators prefer to speak of 'sustainability' rather than 'sustainable development', in order to eschew the exploitative connotation in the uncritical use of the word 'development'... p14*

In general terms the concept of sustainability is used because it

- is appropriate across cultural diversity
- de-emphasises economic growth and increased consumption as the central basis of human wellbeing
- encompasses the complexity of contemporary global and local issues and
- emphasises the dynamic, open-ended nature of the processes by which remediation of contemporary issues might be attained.

#### **4.2.4 The emergence of sustainability issues: a multidimensional understanding**

The phrase 'sustainability issues' is used here to describe the suite of complex and interrelated conditions, for which there is no general agreement on specific, identifiable causes, let alone remedial strategies<sup>29</sup>. It refers to issues that arise within dynamic complex systems that are often the unintended consequences of other actions. Beck (Beck, 2006) describes unintended consequences as:

*... latent side-effects, which have their own independent dynamic. (e.g. climate change is an unintentional side effect of modern progress). .... [arising] due to the autonomous dynamic of processes of modernization which have acquired an impetus of their own and which are quite blind to consequences and quite deaf to warnings of danger. p34*

Sustainability issues are multifaceted, and multidimensional, entwining social, ecological, cultural and economic layers of activity (Kane, 1999) p22. The close relation with complexity indicates that sustainability issues are not likely to be resolved by reductionist or simplistic approaches. Bromley (Bromley, 2007) summarises many aspects of sustainability:

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<sup>29</sup> These and other aspects of complexity were discussed in the previous chapter.

*Sustainability is about the world to be inherited by future persons (Bromley, 1998). Sustainability is not about what would be efficient (or even fair) for the present generation to bequeath to the future... Rather, we are compelled to ask what future persons would like for us to do now in order that their world might be more to their liking than if we were to pass on to them what is efficient for us. ...Unfortunately we cannot know what sort of world future persons will prefer. In the absence of that, the standard story is to make sure that irreversible options are not undertaken now that will preclude desirable outcomes for future persons. While necessary, this is not sufficient. The abiding obligation to fall on present persons is to create a policy process that avoids policy lock-in. Pp678-9*

Sustainability issues occur across the socio-economic spectrum – i.e. for rich and for poor – but for different motives and reasons. For the rich, over-consumption creates waste, inefficient use of resources and ‘diseases of civilisation’ (Inglis, 1981). For the poor, hunger and insecurity are primary but can also lead to exploitation of local resources such as over-grazing or destruction of forests for firewood or cash crops, or piracy or illegal logging to eke out a livelihood (Turnbull, 1972). There may be resort to antisocial activities such as piracy to ensure daily survival. In this sense, poverty is both a ‘cause’ and effect. It is not difficult to see that biophysical degradation and socio-cultural dysfunction are intertwined. As Espinosa and Walker (Espinosa and Walker, 2011) explain:

*Rather than understanding sustainability as a ‘constancy’ in development, we can understand it as the ability of a living system to co-evolve with its environment. p19*

Sustainability issues transgress time-scales and geographical borders (Weaver and Rotmans, 2006). They represent a suite of global threats to the ecological dynamics on which life on earth is dependent. The extent of biophysical degradation and socio-cultural malaise are well documented elsewhere<sup>30</sup>. As described in the chapter on the imperatives for effective sustainability policy, the significance and

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<sup>30</sup> GARNAUT (2008) Garnaut Climate Change Review: Interim Report to the Commonwealth, State and Territory Governments of Australia. Canberra, Australian Government, BARBIER, E. B., BURGESS, J. C. & FOLKE, C. (1994) *Paradise Lost? The Ecological Economics of Biodiversity*, London, Earthscan, BERZ, G. A. (1999) Catastrophes and Climate Change: Concerns and Possible Countermeasures of the Insurance Industry. *Mitigation and Adaptation Strategies for Global Change*, 4, 283-293, DIAMOND, J. M. (2005) *Collapse : how societies choose to fail or succeed*, New York, Viking, CAIRNCROSS, F. (1992) *Costing the earth : the challenge for governments, the opportunities for business*, Boston, Mass, Harvard Business School Press, MEADOWS, D. H., MEADOWS, D. L. & RANDERS, J. (1992) *Beyond the limits : confronting global collapse, envisioning a sustainable future*, Post Mills, Vt, Chelsea Green Pub. Co, RICHARDSON, B. J. (2002) *Environmental regulation through financial organisations : comparative perspectives on the industrialised nations*, Hague ; London, Kluwer Law, STERN, N. (2006) *The economics of climate change: The Stern Review*, Cambridge, UK, Cambridge University Press.

extent of the issues, and the apparent incapacity to ameliorate them, remains a major policy challenge. As Svedin (Svedin, 1991) writes:

*There is in our time an uneasiness among politicians, scientists and citizens alike, that the biological foundations upon which all life depends are being heavily eroded. The concern takes many shapes, e.g. the concern about losing biodiversity of species, the chemicalization of toxic elements into the environment to an extent which was never there before, or of man-induced climate change, thereby threatening certain forms of biological life in certain places... p8*

Contemporary sustainability issues are unprecedented in their complexity, scope and scale. They challenge governance systems, economics, science, policy, law, engineering and other disciplines (van de Kerkhof and Wieczorek, 2005).

In broad terms, it is suggested here that sustainability issues emerge because:

- Current paths of expansion and development (including but not limited to overconsumption and population increases (Rammel and van den Bergh, 2003)) are beyond the capacity or resilience of ecosystems to adapt (Kemp et al., 2005) (Walker, 2001), absorb or recover; these impacts are occurring on an unprecedented scale and they are exacerbated by the globalisation that occurred in the 20<sup>th</sup> century (Modvar and Gallopin, 2005) p23
- Cultural normalisation of specialised activities that create alienation and ‘diseases of civilisation’ (Inglis, 1981), or what Hamilton (Hamilton and Denniss, 2005) calls ‘Affluenza’<sup>31</sup>
- In the broad cultural episteme of modernism, consumerism has replaced citizenry: quantity of goods in possession is the yardstick by which wellbeing is measured; quality of life is marginalised in accounting processes. Although aspects of modern lifestyles have increased amenity for some world citizens, contemporary economic expansion is dependent on waste, exploitation of the environment,

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<sup>31</sup> “Affluenza describes a condition in which we are confused about what it takes to live a worthwhile life. Part of this confusion is a failure to distinguish between what we want and what we need. ...The problem is not that people own things: the problem is that things own people. It is not consuming but consumerism we criticise; not affluence but affluenza.” HAMILTON, C. & DENNISS, R. (2005) *Affluenza : when too much is never enough*, Crows Nest, N.S.W., Allen & Unwin. Pp7,17.

and inefficient use of resources. Waste and exploitation are justified on the grounds that continued material expansion reduces scarcity. It presumes that economic growth can go on forever, even though economic expansion is itself the cause of problems.

- Conventional policy for dealing with sustainability issues is based on the power of market forces and a reliance on economic growth, engineering, new technology, or resource substitution (Sendzimir et al., 2006) to resolve issues. Humans have presumed that they have the capacities to control, or predict or manage adverse outcomes and that economic growth will produce enough goods to rectify any damages done; however, expansion *per se* does not ameliorate scarcity. As Espinosa and Walker (Espinosa and Walker, 2011) state:

*... many of the global developmental approaches still operate within an inappropriate mind frame, with mankind exploiting its natural habitat in the name of economic growth p3.*

- Maldistribution of resources facilitates environmental exploitation: poverty and habitat destruction co-exist with surpluses, over-consumption, affluence and technological progress on other parts of the planet. Across the globe, resources are being exploited beyond regenerative capacities (Meadows et al., 1992).
- The significance of culture is underestimated. The loss of indigenous cultures and traditional wisdom leads to a loss of sustainability for all. Furthermore, at a different level, culturally embedded issues require different approaches than issues that are superficial expressions. If the cultural context is ignored, the root causes of issues are easily overlooked and policy becomes malframed. As Meppem states, consideration of cultural context and diverse epistemological perspectives are essential, otherwise "... something that profoundly affects our actions is hidden from us." (Meppem, 2000) p49

- Sustainability issues are unintended consequences of modernist practices – social, cultural and economic – from human actions, organisations and technologies. Being unintended, they occur outside conventional cultural or social parameters and are not easily attributable to specific actors. They may manifest in different geographical locations from where the actions originated, or they may occur with time lags that were not considered when the original action was undertaken. They may have been culturally rationalised or ratified, as the price humanity has to pay for progress<sup>32</sup>.
- Sustainability issues result from transgressions of biophysical and socio-cultural limits. The transgressions relate to the capacity of ecosystems to absorb waste, the capacity to regenerate after destruction, or replenish after extraction, and the capacity to withstand changes in environmental context. Although the practices creating the ecosystem damage and species' extinctions are known, no effective governance or policy pathway has emerged to correct the broad trends that indicate disaster (Meadows et al., 1992). The significance of the predicament is summarised by Bateson's perception that an organism that destroys its environment destroys itself (Bateson, 1987).
- The complexities of sustainability issues are poorly recognised as are the forms of uncertainty that are not solvable with more knowledge or research (Asselt, 2000). The five categories of the spectrum of uncertainties that emerge from complex systems were described in the previous chapter. Cognisance of complexity is an essential prerequisite for addressing sustainability issues. Some of the key

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<sup>32</sup> However, there are examples of cultures that emphasise living in harmony with nature through symbiotic cultural practices TURNBULL, C. M. (1968) *The forest people*, New York, Simon and Schuster.. History provides many examples where social transformations have occurred that make human existence more sustainable: the public health reforms of the 19<sup>th</sup> century, for instance SMITH, V. (2007) *Clean: a history of personal hygiene and purity*, Oxford, Oxford University Press..

aspects of a policy framework required to address sustainability issues are discussed in chapter twelve.

### **4.3 Conceptualising change**

#### **4.3.1 Sustainability as narrative**

A robust sustainability narrative is required to contextualise policy processes and facilitate acceptance of sustainability-informed behaviour in the cultural context: that is, to build community acceptance of the required behavioural changes and constraints. Tàbara and Pahl-Wostl (Tàbara and Pahl-Wostl, 2007) explain that sustainability policy

*... simply cannot resolve a problem that is culturally rooted in the way that science and policy view and interpret the relationships between natural and social systems and the role of knowledge production. NP*

Meppem and Bourke (Meppem and Bourke, 1999) (p393) have distilled four main sustainability narratives from the literature: the environment as a 'stock of assets'; environmental systems and carrying capacity; the environment as 'our world'; and the environment as a cultural conception.

Sustainability carries with it the implication of caring for natural and social environments so that life and quality of life can be sustained for present and future generations (Leman-Stefanovic, 2000) p4.

The challenge for sustainability as a narrative is comparable with that faced by those trying to bring in public health reforms following the 'discovery' of the germ (Waller, 2004) in the 19<sup>th</sup> century: public health reforms required alterations to lifestyle practices, vast expenditures on infrastructure and facilities. At the time some people could not grasp or accept the science of germ theory. The policies devised to accommodate the new awareness of germs did impinge on individual 'rights', and it did require behavioural change. It needed to be integrated at a macro policy level and at an individual behavioural level: one person practicing good hygiene is not effective without broader public health initiatives. It ultimately led to a greater individual and collective wellbeing, and, despite being perceived as an

imposition in the first instance, public hygiene has become naturalised into the cultural episteme.

Sustainability elicits different perspectives from people and that shapes the nature of their approach to issues, and the responses that they make:

*The approaches to causalities are thus different in character depending on which perspective is used: an economic or an ecological one. The choice of systems boundaries is different in time and scale, the choice of variables is partially different and the emphasis on various elements differs. This holds true not the least with regard to the role of information in the various systems... The differences in approaches exemplify the varying analytical contexts within which root causes are emphasized differently and within which the pattern of causalities is thus given different forms. (Svedin, 1991) p13*

Meppem and Bourke (Meppem and Bourke, 1999) suggest that sustainability requires a “grand reflexive narrative” in order to

*... promote the consideration of the environmental debate as a contested space based on conflicting stories. A grand narrative refers to a dominant ‘world view’ or ‘belief system’ which permeates all social interaction justifying, reinforcing and moulding change. ... Each sustainability narrative is taken to represent a broad sectional interest group. This discursive approach aims to place each narrative within a broader historical context in a bid to reveal their underlying belief systems and value sets. These stories describe different ‘world views’ of common concepts ... A discursive approach promotes a reflexive communicative rationality for the development of shared meaning in sustainability planning. p393*

A properly constructed sustainability narrative can provide the context in which a sustainability-informed economics is accepted and understood by the general public. A narrative is framed by, and contributes to, the ontological structure used in analysis and these dynamic, iterative attributes are crucial to the framing and learning aspects of sustainability policy.

#### **4.3.2 Learning about sustainability: an heuristic response**

Ongoing learning is required for sustainability because complex issues cannot be explained by definitive answers. The dynamic, evolving nature of the sustainability concept requires ongoing learning to facilitate adaptive decision-making and the creation of a robust sustainability narrative. Learning about the multidimensionality of issues – sustainability learning – is an integral part of the path to sustainability.

These three types of learning are summarised here and discussed in detail in the chapter on the sustainability-informed policy framework:

- sustainability learning, which provides awareness of the issues
- social learning, which focuses on the sustainability narrative needed to find ways of accommodating pluralist perspectives and values, and developing adaptive strategies for living with the irreducible uncertainty of sustainability issues
- policy learning, which focuses on how effective and viable decisions can be made in the context of urgency, complexity and uncertainty.

#### **4.3.3 The amelioration of sustainability issues: a multilevel approach**

The resolution of sustainability issues can be approached at five levels (Burke, 1996):

1. the biophysical and socio-cultural dimensions in which the issues actually manifest
2. the management and scientific approaches to the issues, and the problems of strategic consensus and co-ordination contained therein
3. the governance framework (e.g. legislative and administrative) in which the jurisdictions and responsibilities for attending to the issues are addressed
4. the cognitive, conceptual, ontological and cultural perceptions and assimilations of the issues by which the general public policymakers consider the significance of the issues and the need for actions
5. the policy framework in which strategies for amelioration are created and implemented: the 'transition to sustainability' phase and how it is carried out.

Effective approaches to sustainability issues need to include coherent considerations of all five levels. How to bring this about is a major challenge for



policy makers and those exercising power of governance. More than better utilisation and/or reform of existing approaches are required.

#### **4.3.4 Sustainability principles**

Sustainability can be framed within an evolving set of principles (Richardson and Wood, 2006a, Dovers, 2005b). The principles that underpin the concept of sustainability may be summarised as:

- generational equity (social justice)
- intergenerational equity
- ecological integrity
- the precautionary principle
- effective and inclusive public participation
- legal transparency
- adaptive governance
- cultural respect and integrity.

Different authors give different emphases to these principles. Richardson and Wood (Richardson and Wood, 2006a) explain that the sustainability discourse has generated normative principles such as intergenerational and intragenerational equity, and integration of development with its consequences, that need to be incorporated into the policy process, rather than applying a precise formulae for policy. Sachs (Sachs, 1999) (p33) talks about social justice and full democracy as the two core aspects of sustainability processes. Richardson and Wood (Richardson and Wood, 2006a) emphasise public participation and human rights, and protection of social and cultural rights especially for indigenous peoples. Spangenberg (Spangenberg, 2001) highlights the precautionary principle. These principles are well documented in the literature, but further discussion is presented in chapter 13.

#### 4.3.5 Sustainability as a policy challenge

Complexity and uncertainty make sustainability a major policy challenge (Voss and Kemp, 2006). As Froger and Zyla (Froger and Zyla, 1998) describe complexity as incorporating unpredictability and emergence. Complex systems are not deterministic, thus rendering probability calculations inappropriate (p289)

Sustainability is itself an evolving concept (Kemp et al., 2005) reflecting a dynamic *process* of adaptation and change as ongoing interpretations, information, awareness and perspectives develop (Kane, 1999, Kohn et al., 1999b).

Sustainability policy goals are unpredictable moving targets (Clark, 1991b) p411 and the path to sustainability is open-ended. Without a specified endpoint the conventional plan-then-implement approaches to policy become inappropriate. Spangenberg (Spangenberg, 2001) writes that sustainability is not a goal-oriented policy process:

*... sustainability delivers no ready-made vision of how the world should be; rather, it helps in defining targets by providing criteria based on a diversity of goals. There can be no such thing as a blueprint of a sustainable society. This understanding of sustainable development contradicts the monetary approach that is based on cost as the sole criterion for determining one optimal solution. p31*

A shift from goal orientation to process orientation is needed for sustainability policy (Gasparatos et al., 2009).

Sustainability is a challenge for contemporary policy makers because it does not 'fit' into conventional policy processes. Sustainability issues are different in kind and degree to the sorts of problems that conventional policy approaches and institutional structures were designed to address (Dovers, 2003b). Dovers and Handmer (Dovers and Handmer, 1997) explain that:

*Sustainability is indeed characterized by deep-seated contradictions— paradoxes, conflicts, and tensions— between perhaps irreconcilable goals or directions. These go well beyond the expected normal differences between political rhetoric and practice. p2*

Making changes toward sustainability is complicated because not all policymakers accept sustainability as an achievable, operational or workable option. Dovers (Dovers, 2003b) suggests that:

*...those in the sustainability field are generally sympathetic to [sustainability], whereas those in traditional policy-oriented disciplines (e.g. law, public policy, neoclassical economics, public administration) tend to be dismissive. p3*

That is, even if one were able to resolve the complexity of the issues, there is resistance to sustainability-oriented changes because they challenge conventional institutional structures and ways of thinking on which policy is created.

Brady (Brady, 2005) suggests that sustainability policy needs an iterative approach to decision making that:

*.... moves away from reactive, incremental policy making towards anticipatory, integrated approaches. It necessitates the introduction of creative and flexible regulatory practices that are problem-led, rather than anchored in fixed organisational or ideological structures. p402*

Froger and Zyla (Froger and Zyla, 1998) argue that managing in complex situations requires

*... a creative effort of analysis through the adoption of a different type of rationality, called procedural rationality. Pp287-295*

They suggest an approach called “procedural rationality” that does not use a particular method to solve a problem in an optimising manner. Instead it provides decision-makers with ‘a more adequate conception of rationality’ in which a variety of analytical options are brought together in ‘an orderly and structured way’ (Froger and Zyla, 1998). They say that procedural rationality is compatible with system dynamics modelling, as well as being consistent with the precautionary principle and the sustainability principle of intergenerational equity.

#### **4.3.6 Implementation issues for sustainability policy**

Sustainability requires more than conventional ways of thinking, structures or causal relations. Effective sustainability policy needs approaches, structures and methods that are able to accommodate the diversity, interrelatedness, dynamic, multi-scaled and multifaceted nature of sustainability issues. Voss and Kemp (Voss and Kemp, 2006) state that the approach is

*... more about the organisation of processes than about particular outcomes. It is about the modes of problem treatment and the types of strategies that are applied to search for solutions and bring about more robust paths of social and technological development. p4*

Implementing effective policy requires more than awareness of the need for sustainability. Formulation of policy does not automatically ensure effective implementation. Bressers (Bressers, 2004) describes implementation as:

*... the process(es) that concern the application of relevant policy instruments. Such processes can, of course, work as intended. But it is also highly possible that application is hindered, delayed or even prevented during the process.*  
p284

Implementation processes are context-dependent and vary accordingly (Hill and Hupe, 2002). There is no generally accepted implementation theory from which analysis of implementation issues and approaches may be framed. Hill (Hill and Hupe, 2002) describes public policy implementation as “... a sub-discipline of political science and public administration”.

The challenge of implementation is to convert ideas into effective outcomes. Hill (Hill and Hupe, 2002) lists various descriptions of implementation: ‘pragmatization’; ‘the post-legislative stages of decision-making’; ‘the stage in the policy process concerned with turning policy intentions into action’; ‘a comparison of the expected versus the achieved’; ‘Inputs’ go into a system and called ‘outputs’ and ‘outcomes’ come out. Implementation can be seen as a part of the ‘throughput’ taking place within the ‘system’.

#### **4.4 Conclusion**

Sustainability is an evolving concept that can provide an overarching policy framework for addressing complex issues confronting contemporary policy makers. Sustainability can accommodate the multifaceted and multidimensional aspects of complex issues.

As a narrative, sustainability encompasses and reflects differing value systems and multiple perceptions of causalities. Sustainability provides a framework for ongoing learning about issues, decision-making and respect for pluralist values and perspectives.

The dependence on interpretation, conceptual malleability and open-endedness of the sustainability concept makes it problematic for conventional processes that

strive for certainty as a basis for action. Convincing policy makers that approaches and processes need to be adapted to incorporate the new awareness of complexity and sustainability is a major challenge of the age (Harris, 2007).

Contradictions are inherent to sustainability; therefore sustainability issues are best addressed with policy processes that assess a range of options, rather than solely engineering, economic, regulatory or other monodimensional strategies that focus on finding a 'solution'.

The next chapter discusses the neoclassical economic interpretations of sustainability and assesses the adequacy and appropriateness of the neoclassical economic theory and episteme as a framework for sustainability policy.



## **Chapter 5: Neoclassical economics and sustainability: interpretations and implications**

### **5.1 Introduction**

Discussion of the imperatives for effective sustainability policy suggested that the conventional approaches to policy needed scrutiny. The discussion on complexity showed that there is a suite of new understandings about causal relations, analysis and frameworks that needs to be incorporated into the policy processes used to deal with contemporary issues. The discussion on sustainability showed that it is an evolving multidimensional concept that, on one hand, is able to accommodate the new understandings of complexity, but on the other hand, has inherent aspects that are challenging for conventional policy processes.

This chapter examines the neoclassical economic interpretation of sustainability because, as Kane (Kane, 1999) explains:

*... if economic sustainability is inconsistent with maintaining the long-term capacity of the biosphere to support human life, there is obviously a problem.*  
p21

The aim is to scrutinise the adequacy and appropriateness of neoclassical economics as a framework for sustainability policy. There are many extant criticisms of neoclassical economics that are not detailed here. Instead the discussion will focus on the way neoclassical economic discourse interprets sustainability, the adequacy and appropriateness of this interpretation, how this interpretation adapts the sustainability concept to fit the theoretical framework, and how this process of arrogation creates policies that are inherently ineffective and lead to exacerbation of sustainability issues. The purpose in this chapter is to demonstrate that changes away from neoclassical economics are needed in the broader economic discipline in order to meet the new demands and understandings of complexity and sustainability. The justifications for change, and the way changes may be brought about are discussed in subsequent chapters: Chapter 5 details how neoclassical economic interpretations of sustainability impact on the efficacy of the sustainability policy process; chapter 6 describes the dysfunctional relationship that

exists between neoclassical economic theory, practice and conceptual underpinnings; chapter 7 describes some of the implications of this dysfunctionality; chapter 8 discusses the need for conceptual change and suggests the means by which such changes may be brought about; and chapter 9 describes what an economics that is symbiotic with sustainability would look like.

## **5.2 The neoclassical economic discourse and the interpretation of sustainability**

The term 'neoclassical economics' is used in this thesis as generic descriptor of the economics discipline that emerged in the later part of the 19th century. It is usually described as beginning with the work of Jevons, Walras, Marshall and Edgeworth (Blaug, 1997, Roll, 1973 #217). The key characteristics of this development in economic methodology and conceptualisation that are relevant to this thesis are the use of mathematics as the principal tool of analysis, the analysis of economic activity in the abstract, and the surety that the invisible hand of the market mechanism will deliver optimal outcomes for society – if only the conditions necessary for the market mechanism to operate efficiently can be brought into being (Ropke, 1998). These characteristics have a significant effect on sustainability policy processes because the emphasis on neoclassical economic policy is to bring real world conditions into as close alignment as possible with the conditions for optimality defined in the abstract mathematical theoretical models.

*Neoclassical economists seem to be prepared to confine themselves to the questions which suit their methodology instead of displaying a willingness to embrace alternative methodologies that 'reach the parts their own cannot reach'. (Earl and May, 1992) p37*

Earl (Earl and May, 1992) suggests that the result is that the focus of neoclassical economic policy with respect to sustainability is to estimate and internalise externalities, and to devise ways in which public policy can create the market conditions necessary to bring this about.

Using an ideal-type framework as the basis for economic analysis means that the inaccuracy and lack of success in predictions, etc, can be explained away because the ideal conditions needed to make the predictions work did not exist.



Neoclassical economics shifted the emphasis away from descriptive and historical approaches: the aim was to use mathematical precision and abstract ideal-type analysis to make economics a precise science. The mathematisation of economics is well documented (Schabas, 1990, Mirowski, 1991, Walsh and Gram, 1980, Weintraub, 2002). The emergence of neoclassical economics represented a shift away from the classical economists' focus on the search for economic laws, to a neoclassical focus on construction of mathematical models. In terms of sustainability policy, the move to neoclassical economic modes of operation removed the capacity to adapt as a discipline when the biophysical and socio-cultural limits of planet earth were acknowledged in the late 20<sup>th</sup> century.

As a result, modern neoclassical economic analysis and policy is constructed as if it were an objective discipline akin to engineering, where the tasks are to understand the economic 'machine', and to calculate the magnitude of various forces, and establish laws and relationships. For neoclassical economists, economic policy is a matter of finding initiatives that 'tweak' the system to keep it on a stable growth/expansionist path; it uses externalities and market failure to explain the lack of sustainability in the modern world, and depends on concepts such as natural capital, human capital and social capital to explain the neoclassical economic approach to environmental problems and sustainability.

The dominance of the neoclassical economic approach in policy processes, as well as the conceptual dominance of newer branches of economics, such as ecological economics, have implications for the efficacy of policy approaches to sustainability issues that are the focus of this thesis (Illge and Schwarze, 2009, Gowdy and Erikson, 2004). Brohman (Brohman, 1995) explains how the close relationship between neoclassical economic theory and neoliberalism creates a narrow, economics-based approach to policy which marginalises, conceptually and practically, the involvement of socio-cultural and political dimensions in sustainability issues. These aspects, together with the issues that neoclassical economic methodologies create in environmental economics, are discussed in chapter 7.

Meppem and Bourke (Meppem and Bourke, 1999) describe the neoclassical economic interpretation of sustainability as:

*... a belief in a quantified unitary value appraisal system which subsumes dominance over multiplicity and diversity to posit a 'world view' that excludes effective representation, promotes top down strategies, reinforces hegemony and dictates acceptable 'ways of knowing'. This narrative excludes the very attributes that we argue here are central to developing meaning in sustainability. p394*

Other examples are listed in Table 5.1. A summary of neoclassical economic interpretations of sustainability principles is provided in Table 5.2.

<b>Table 5.1 Some neoclassical economic approaches to sustainability</b>
<p>"In market economies, economic sustainability is usually defined as a firm's ability to maintain its market share under competition. The core group of indicators for assessing performance according to this narrow definition of economic sustainability consists of liquidity and solvency ratios, profitability ratios and growth ratios. However, the exclusively monetary quantification of flows and stocks at the micro level is not only unable to reflect a firm's level of sustainability but also may lead to a misleading assessment. ... the dominant economic concepts tend to reduce business to profit-maximising and cost-minimising entities by stressing the role of costs in competition. This, however, is exactly the opposite aim of strategic sustainability management, which should proactively identify the environmental and social as well as the economic risks and see the opportunities for new products and markets in the changes induced." (Spangenberg, 2001) p38</p>
<p>"The popular view seems to be that "the pursuit of economic growth has environmental costs, and a clean environment has economic costs. The challenge is to find compatible and sustainable combinations of the two ... Yet I would argue that the challenge of sustainability involves much more than a juggling act of individual entities, such as natural resources and economic concerns. ....ecologists have promoted an understanding not only of individual organisms, but of whole ecosystems in terms of the interactions and interdependencies of living and nonliving entities." (Leman-Stefanovic, 2000) p46</p>
<p>"Every fundamental economic textbook deals with the (circular) flows of money and goods between households, companies (and other organisations), while from a sustainability point of view it is mainly the resource and waste flows (the societal/economic metabolism)." (Rammel et al., 2004) p8</p>

<b>Table 5.2: Neoclassical economic interpretations of sustainability principles</b>		
<b>Principle</b>	<b>Implication</b>	<b>Current Economic Interpretation</b>
Ecological Integrity	Environmental well being is a parameter	Environment is a free good external to the system
Intragenerational Equity	Social Justice and Equity; Equality of opportunity, democratic public participation	Market power (access to money) determines involvement; economic efficiency and market stability is more fundamental than democracy
Intergenerational Equity	Respect the needs of future generations	Discount future in favour of present
Public Participation	Effective, efficient and legitimate involvement of public in decision-making processes	Citizens become consumers who participate and exercise their citizenry power through their purchases in the marketplace
Precautionary Principle	Consider irreversibility and 'lock in'; Accommodate complexity and uncertainty in analysis, decision-making & management	Optimisation of use of resources for current generation; Depend on substitution and technological advance; Assume homogeneity with price & quantification
Cultural Respect	Diversity of values, beliefs, customs, epistemologies, mythologies, ways of being	Homo oeconomicus

### **5.3 The adequacy of neoclassical economics as a policy framework for sustainability**

'Adequacy' is used to describe the relationship existing between idea and reality.

Maurer (Maurer, 2005) describes adequacy as being derived from the Latin

*'adequatio intellectus et res'*:

*...the action of bringing one's concepts in accord with reality, words with things, mind with matter. (Maurer, 2005) pxiii*

The issue here is whether the neoclassical economic interpretation accords with the complexity of the world as it is now understood (Bertuglia and Vaio, 2005, Goodwin, 1994, Harris, 2007, Manson, 2001, Roe, 1998), and whether it has the flexibility to address complex issues? In other words, to paraphrase Maurer (Maurer, 2005), is the neoclassical economic conceptualisation of reality, words and things, 'adequate'?

Neoclassical economists generally acknowledge the unreality of the assumptions and the need for metaphors (Backhouse, 1994) to explain their perspectives. The use of simple assumptions and abstractions<sup>33</sup> is justified on the grounds that it

<sup>33</sup> Since abstraction "... involves purposive selection, abstract theory is inevitably fragmented and context and purpose-specific. The problem, then, with abstractionism is that proponents of a particular partial abstract representation assert its completeness and hypostatize its structure and assumptions."

provides a useful way-of-thinking from which broader conclusions may be drawn. However, the emergence of complexity theory means that the legitimacy and applicability of this 'ideal-type' abstract analysis for complex situations is questionable. The problem is that abstractions *de facto* remove the complexities of the contextual reality in which issues arise.

The argument is not against abstractionism *per se*, but against the dominance of hyper-abstract methodologies used in economic analysis and the hypostatised conjunctural abstractions that are the subject and object of modern neoclassical economic approaches. Goodwin (Goodwin, 1991) describes the methodological and analytical aspects of neoclassical economics as being 'virtually inseparable' with 'little possibility of doing anything other than extending the accepted methodologies' <sup>34</sup> p151. That is, economic analysis is constrained within its own methodological and conceptual framework to the extent that economic methodology defines the economic issues that can be analysed, and the modes of analysis constrain the methodologies that can be used. This makes for little adaptive capacity for reframing issues or relationships or methodologies to accommodate the new understandings of complexity theory. In addition, exclusive use of abstract analysis to frame issues and construct the variables to be analysed, serves to untether economic policy from the biophysical and socio-cultural contexts in which sustainability issues manifest.

Abstraction needs to be applied reflexively in analysis of complex issues where the interactions between the general and the particular, the micro and macro, the past and the future are not linear mathematical relationships. Findings derived solely

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WINTHER, R. G. (2008) "Vicious Abstractionism" and "the Philosophic Fallacy": James and Dewey on the Promises and Limits of Abstraction. Department of Philosophy, University of California, Santa Cruz. P1

34 "... Neoclassical economics has developed its methodology in relation to its content in such a way that the two aspects are virtually inseparable; but the methodology has become the tail that wags the dog. This system of theory is inhospitable to any content which cannot well be handled by the elaborately developed methodologies now in use, because it would be unthinkable to reverse the direction in which the methodology is developing. ... The reward systems and status orderings which have become attached to neoclassical economics (as, over time, some sort of reward and status systems inevitably become attached to any developed system of theory) are now closely related to a unidirectional type of progress which contains little possibility of doing anything other than extending the accepted methodologies." GOODWIN, N. R. (1991) *Social Economics: An Alternative Theory*, St. Martin's Press. Pp151-152

from abstract analysis cannot be meaningfully generalised or interpolated in complex situations.

The abstract analysis used in neoclassical economics is a legacy of the generalised Platonic worldview that abstractions are “... instantiations of a transcendental world of pure forms that [exist] behind the veil of the physical world” (Wikipedia). This perspective is based on the *belief* that the abstract world has an internal consistency that is more consistent than the material world. It also believes that the abstractions and the relationships between them can be discovered and described mathematically, and that the purity and unbiasedness of mathematics provides (or proves) the scientific integrity of the analysis. The perspective holds that conclusions from ideal-type analysis are transferrable to, and provide understandings of, the complexities of the socio-cultural and biophysical world that they underpin. Neoclassical economists believe that their analysis removes the veil of complexity and that it is necessarily abstract to establish what is really going on to provide clearer understanding of the economic laws and forces that govern the world we live in.

However, this worldview does not accord with contemporary understandings of reality consisting of living, dynamic complex systems. As described above, complex systems have emergent properties, meaning that the behaviour of the system cannot be understood from the behaviour of its component parts. Winther (Winther, 2008) explains that it is a profound error to take “... partial abstract representations as exact models of the entire world” but there is a “dangerous nature of abstractionism’ that leads to “ubiquitous” ‘inference patterns” being applied from partial abstractions as generalisations:

*...the agent forgets or denies that the process of abstraction has been performed. Instead, she insists on the completeness of her abstractions in capturing the world and remains indifferent to other perspectives. The inferential pattern, then, is valid abstraction followed by unjustified abstractionist exaggeration. p1-2*

Winther argues that a plurality of abstractions and beliefs need to be considered (Winther, 2008) p4.

Christensen (Christensen, 2001) argues that it is

*... inappropriate to base production theory and environmental economics on concepts which are incompatible with the operations of the physical and biological world. p16-17*

Neoclassical economic approaches are framed without critical awareness of complex real-world phenomena: for instance ecological dynamics, biodiversity and the irreversibility of living systems. The basic problem is that simplistic abstract perspectives and interpretations over-ride consideration of the complexities that are creating the issues. In practical terms, this causes issues to be misconstrued and policy approaches to be malframed. The events by which the sardine fishery collapsed in California, as described in Steinbeck's novel "Cannery Row" (Steinbeck, 1992) provide a pertinent example. At the time of writing, there is significant public debate about the economic viability of the super trawler 'Abel Tasman' and whether it will destroy the biological viability of the fisheries in which it operates. Similarly, in Greece and elsewhere in Europe, the sovereign debt crisis is causing nationwide riots which are indications that the neoclassical economic framework is not able to accommodate the non-economic implications of contemporary issues.

#### **5.4 The arrogation of sustainability to suit the neoclassical economic framework**

The neoclassical economic interpretation adapts the sustainability concept so that it fits within the Cobb-Douglas production function framework that underpins modern economic growth theory (Cobb and Douglas, 1928). This process of conceptual adaptation to suit the parameters of the economic discipline is called arrogation. 'Arrogation' is defined in the Australian Oxford Dictionary (Moore, 1999) p68 as "claiming (power, responsibility, etc) without justification".

I describe the re-interpretation of sustainability to suit the neoclassical economic framework as arrogation. Arrogation is undertaken so that sustainability accords with the abstract framework of neoclassical economics. The arrogation of sustainability denies the scientific integrity of the evolved concept of sustainability. The multidimensional concept of sustainability has been reconceptualised within the neoclassical economic discourse as a simplistic monodimensional *economic*

*interpretation* of sustainability. The dysfunctional relationship that results is discussed in the next chapter.

Stirling (Stirling, 2006) (p235) uses Wynn's (Wynn, 2002) phrase 'legitimatory discourse'<sup>35</sup> to describe the process of strategically usurping a concept for one's own purposes. Teivainen (Teivainen, 2002) explains how neoclassical economists use

*... a strategy of defining certain institutions and issues as 'economic' and using the doctrine of economic neutrality to produce a boundary between the 'economic' and 'political' spheres. p1*

The prime example of arrogation is the conceptualisation of reality as existing of various forms of capital – natural capital, human capital and social capital – so that the breadth of economic analysis can be expanded without actually changing the analytical framework. That is, the conceptualisation of the world is created to fit the methodological and analytical techniques of the discipline. Poovey (Poovey, 2001) describes this as part of the process of commodification:

*...it is a sign of the regime in which quantification and abstraction work together within the logic of abstraction, whose pre-eminence has grown in the last five centuries. This governing abstraction is capital, which is also a social relationship that has taken the form of a thing. p401*

Conceptually adjusting the complexities of biophysical and socio-cultural domains as various forms of capital is not commensurable with any other scientific understanding. There is no commensurable intellectual integrity in this neoclassical economic perspective of the world as consisting of various forms of capital. As Gallopin (Gallopin, 2003) puts it:

*The classical economist view ... regards the economy as the relevant system, and relegates nature to the role of provider of natural resources and services and of a sink for the wastes produced by human activities... This is consistent with the notion of "very weak sustainability". The very weak sustainability approach asserts that natural and manufactured capital can*

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35 ... 'legitimatory discourse' ... involves the appropriation of the language of sustainability, in order to justify different normative, or instrumental ends. ...this kind of legitimation can often indicate a lack of reflexivity in governance. Moreover, there is no doubt about the important (and often invisible) role that this kind of strategic engagement plays.... WYNN, B. (2002) Risk and environment as legitimatory discourses of technology: reflexivity inside out? *Current Sociology*, 50, 459-477. cited in STIRLING, A. (2006) Precaution, foresight and sustainability: reflection and reflexivity in the governance of science and technology. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar. P235

*substitute perfectly for one another. The substitutability of different types of capital implies that the preservation of an aggregate level of natural plus manufactured capital, rather than the preservation of natural capital in particular is crucial. The sustainability of ecological systems is viewed as important only as far as required for the sustainability of the human component. p7*

The arrogation of sustainability leads to a stream of research that ends with a framework that is only valid within neoclassical economism. First there is natural capital to describe nature, then the dichotomy of 'strong' or 'weak' sustainability is developed to describe sustainability in terms of emphasis on natural capital preservation.

*The strong sustainability approach holds that different types of capital (economic, ecological, social) should be independently maintained, in real physical/biological terms.... Weak sustainability places emphasis on the value of safeguarding ecological and biogeochemical processes that are irrecoverable if lost. (Gallopín, 2003) Pp 8-10*

From a transdisciplinary perspective, one major problem is that capital is not commensurable or aggregable. Therefore, the neoclassical economic approach to sustainability is impotent: it requires maintenance of varying degrees of stock or flows of capital, but those stocks and flows cannot be aggregated in ways that can assist management<sup>36</sup>. Gallopín (Gallopín, 2003) explains:

*One major problem lies in the choice of criteria for assigning value to the ecological assets, considering the arguments about the incommensurability of ecological and manufactured capital. p10*

That is, because the various forms of capital are not commensurable, they cannot be aggregated. Therefore, the whole weak-strong sustainability, with its dependence on capitalistic as a worldview is an allegory; it is not an adequate basis for formulating effective sustainability policy. To persevere with analysis framed in this way is to perpetuate inept sustainability policy because it is being conceptualised in a way that has no scientific integrity.

The process of arrogation is based on the covert assumption that such concepts can represent environmental, educational and community values for analytical

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<sup>36</sup> Gallopín provides an explanation of two conceptualizations of sustainability in this respect: "Hartwick-Solow sustainability requires maintenance of the total capital stock (natural and human made) of society, and 'Hicksian sustainability' requires non-decreasing consumption – including consumption of environmental goods and services." P7



purposes<sup>37</sup>. The fact that these reconceptualisations remain, by and large, unchallenged, reflects the pervasiveness of the neoclassical economic discourse, and its naturalisation within the conventional cultural episteme.

The pervasive acceptance of the concepts of natural, social and human capital, and the dichotomy of weak and strong sustainability is a legacy of self-referentialism in neoclassical economics. Kane (Kane, 1999) explains that self-referential economics leads to simplistic framing of sustainability issues:

*The field of economics is perhaps most guilty of considering only its own scope of activity, assuming other layers will operate by the same rules because actors will always be rational in their decision-making and will have all the information they need to do so. Welfare is considered to derive from consumption and as such can be adequately measured by national income figures. Thus, it is barely surprising that a notion of sustainability that comes from a strictly neoclassical economic analysis will involve a simple rule like maintaining the total capital stock at a level that will maintain consumption of goods and services far into the future. p22*

Using the arrogated concept of sustainability as the basis for framing issues has a significant impact on policy. Framing of complex issues with the arrogated worldview of sustainability means that sustainability policy is approached theoretically as an issue of managing various stocks of capital. This reinforces the neoclassical economic discourse which holds that sustainability is

- a cost to the economy
- attainable only through economic growth
- essentially an economic management issue.

This suite of perspectives has helped preserve the dominance of the neoclassical economic interpretation of sustainability among researchers and policymakers. For instance, even the progressive report headed by Stiglitz (Stiglitz et al., 2009) framed their approach to sustainability in terms of "... whether stocks of capital that matter

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<sup>37</sup> I term the view that the world is best understood and analysed by framing it in terms of various forms of capital as 'capitalisticism'. As I see it, ascribing the world as being made of various forms of capital is misleading because the concept implies universality and commensurability. However, it is a gross simplification. I prefer the terms natural assets, human capacity and social capacity. These convey the same descriptions, but avoid the implication that they are a substance that is a quantifiable and distillable essence of productive capacity. This is discussed further below.

for our lives (natural, physical, human, social) are passed on to future generations.”

p11

From a sustainability perspective, these arrogated concepts of capital are operationally unhelpful (Bromley, 2007). The equating of human-made capital with natural, social or human ‘capital’ is a gross simplification. Kohn (Kohn, 1999b) explains that when the environment is referred to as capital, there is an implicit assumption that it can be substituted with other forms of capital, including human made capital. The reality is that ecosystem function *cannot* be meaningfully simplified into an overarching abstraction like natural capital<sup>38</sup>. The concept has legitimacy so long as it remains within the neoclassical economic analytical framework, and it has policy legitimacy so long as neoclassical economics is the framework in which policy is made.

For instance where do trace elements or mychorrhiza fit in the natural capital framework? While a river may be thought of as ‘natural capital’, does it remain so when it bursts its banks and floods surround town sites? Would it then be *negative* natural capital? (The creation of negative phlogiston was one of the concepts developed to overcome unexplainable anomalies in the phlogiston theory.)

In economic terms, conceptualising non-market and intangible goods as various forms of capital is not a solution because, even in the manufacturing sector where one can point at and touch physical capital – such as a machine – ‘capital’ is difficult to define or measure. This problem of measuring capital is an unresolved debate between economists at Cambridge, England, and those at MIT in Cambridge, Massachusetts, USA. The problem is that the value of capital depends on the profitability of the output derived from that capital: a machine that built inkwells is less valuable as a piece of capital now than it was in the 19<sup>th</sup> century, even though the machine may be in good working order. The indeterminacy comes from the fact

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38 “... features of the natural world are more than mere economic inputs, but rather essential and irreplaceable requirements for human existence, it is not enough to assign property rights or find the proper set of taxes and subsidies. Some environmental features simply cannot be assigned a meaningful price. This implies a different agenda ... it means broadening the economists' concept of value to include not only market prices but also unpriceable and even unquantifiable human cultural and environmental features.” KOHN, J., GOWDY, J. M., HINTERBERGER, F. & VAN DER STRAATEN, J. (1999a) The Imperative of Sustainability: Introduction. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar. P3

that the profitability of machine is dependent on the value of the capital: we need to know the value of capital to determine profitability and profitability determines the value of capital. Hence, capital cannot be independently measured. In an attempt to move economic theory forward, Samuelson famously stated: 'Let us assume we can measure capital'. However, as Kaldor (Kaldor and Mirrlees, 1962) wrote:

*... under continuous technical progress and obsolescence, there is no way of measuring the "stock of capital". p307*

If real, physical, visible, human made capital cannot be measured, what chance for rubbery concepts like natural, social or human capital? Thus, as well as being an inadequate portrayal of nature, and part of the arrogation of sustainability, the capitalistic approach is a conceptual cul-de-sac. For economists, the distillation of complex, diverse aspects of sustainability into basic units of capital makes them easier to work with in abstract models that are internally consistent, regardless of the adequacy of the conceptualisation and the methodological flaws that it ignores<sup>39</sup>.

Despite the intellectual paucity of the concept, even ecological economists such as Costanza (Costanza et al., 2001b) frame sustainability accounting in terms of natural capital:

*Green accounting, however, is particularly concerned with loss of natural capital during use. The adjustment measure for sustainable income is always some type of future incomes lost or cost necessary to replace or avoid the loss or degradation of capital productivity. p271*

The arrogated sustainability concept is inhibiting the efficacy of sustainability policy because it conveys a false perception of the complexity of the world in which policy

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<sup>39</sup> "It is important, for the record, to recognize that key participants in the debate openly admitted their mistakes. ... However, the damage had been done, and Cambridge, UK, 'declared victory': Levhari was wrong, Samuelson was wrong, Solow was wrong, MIT was wrong and therefore neoclassical economics was wrong. As a result there are some groups of economists who have abandoned neoclassical economics for their own refinements of classical economics. In the United States, on the other hand, mainstream economics goes on as if the controversy had never occurred. Macroeconomics textbooks discuss 'capital' as if it were a well-defined concept — which it is not, except in a very special one-capital-good world (or under other unrealistically restrictive conditions). The problems of heterogeneous capital goods have also been ignored in the 'rational expectations revolution' and in virtually all econometric work." BURMEISTER, E. (2000) *The Capital Theory Controversy*. IN KURZ, H. D. (Ed.) *Critical Essays on Piero Sraffa's Legacy in Economics*. Cambridge, Cambridge University Press.

is applied. The tragedy is that these concepts of capital have been subsumed into the policy narrative; they are pervasive and many ecologists and natural scientists now talk about ‘natural capital’ as if they are actually referring to something extant (e.g. (Harris, 2007)).

### 5.5 Self-referentialism of neoclassical economics

The question arises as to how the neoclassical economic interpretation of sustainability is maintained? Frow’s description (Frow, 1992) of neoclassical economics as a ‘shoddy’ discipline has already been mentioned. However, there are other less emotive reasons. Psychology and other sciences have identified phenomena such as ‘inattentional blindness’ (Simons, 2007), cultural trance (Korten, 2009), or cognitive illusions (Piattelli-Palmarini, 1994) that explain how well trodden paths to *ineffective* policies can be perpetuated and justified. Keynes (Keynes, 1973) pointed out that the use of theory affects the way in which issues are framed, and people often employ the reasoning of a theoretical framework without realising it.

Bourdieu describes self-referentialism as “imperialism of the universal” which he describes as “universalizing a society's own particularity by establishing it implicitly as the universal model” (Bourdieu, 2005) p225. Meppem and Bourke (Meppem and Bourke, 1999) describe self-referentialism as a coercive tactic that attempts to establish one’s own perspective as the sole truth:

*... the scientific/economic narrative, which dominates the environmental debate, is supported by self-referential analytical and instrumentalist tools, models and surveys, which consciously and coercively attempt to verify the certitude of their own a priori ‘truth claims’. p391*

Self-referentialism indicates a lack of reflexivity. Without reflexivity, anomalies may be disregarded or epistemically justified and deemed insignificant – or they may be assumed to not exist. Bradbury (Bradbury and Rayner, 2002) describes how lack of critical awareness makes

*... the value-based assumptions embedded in theory or model disappear into the background, ... they come to be seen as ‘natural’ and are uncritically accepted. Pp 26-27*

Pollock (Pollock, 2004) describes ‘sketching’ as a process in which one asserts

*... that certain things are inferable on the basis of other things without actually working through the argument. This involves some kind of pattern matching or analogical reasoning... p9.*

Bromley (Bromley, 2007) explains that a definition repeated enough times creates a cognitive illusion that can be 'realised' by the authority and incorporated into the dominant narrative:

*The mere fact that many environmental economists happen to believe that [willingness to pay] is a measure of the "value" of wetlands (or any part of nature) does not make it so. Economists down through the years have shown themselves capable of believing quite fanciful notions. Such belief is merely indicative of a shared set of acquired definitions—learned early in graduate school and continually reinforced by the carefully selected literature to be read (and other literature to be artfully ignored). Moreover, the existence of elegant graphical and/or mathematical demonstrations of this definition cannot possibly establish the truth content of the definition. Such demonstrations simply illustrate—but cannot prove—the definition. p676*

Self-referentialism removes the capacity to adapt approaches to accommodate complex issues because the internal consistency of the framework means that the need for adaptation is not seen! According to Goodwin (Goodwin, 1991):

*Neoclassical economics has achieved a very tight (though not perfect) degree of internal consistency. It thus effectively excludes a large class of novel elements which, in changing some parts of the whole, elaborately interrelated system, would throw out of kilter their relationship to the rest. p151*

Self-referentialism in economics means that findings are corroborated within their own framework, without regard to commensurability with other sciences. It allows self-justification of one's perspectives. Self-referentialism may also result in inattentive blindness (Simons, 2007).

It is not possible to eradicate such biases, illusions or delusions, but awareness of self-referentialism and incorporating reflexivity into a multidimensional policy process can help.

## **5.6 Malframing of sustainability issues and inappropriate policy**

### **5.6.1 Neoclassical economic framework is inappropriate**

In medical terms, iatrogenic describes situations that are caused by examination or treatment of a condition (Moore, 1999) p653. I describe neoclassical economic policy as causing iatrogenic outcomes when it prescribes economic growth as a

solution to the unintended consequences of economic growth. The legacy of iatrogenic policies is maldevelopment<sup>40</sup>.

Iatrogenic outcomes arise from neoclassical economic theory because of its focus on conditions required for stability, optimality and equilibrium within a static abstract model of ideal types, from which policy prescriptions are derived and applied to address complex issues in the material world.

One iatrogenic outcome of this analysis is that continual economic expansion is needed to maintain economic stability in the abstract models used by neoclassical economists (Samuelson, 1939, Domar, 1947, Harrod, 1959, Knox, 1952)<sup>41</sup>. Continual economic expansion as a condition of stability is explained in economic growth theory in terms of the interaction of multiplier effect and the accelerator (Samuelson, 1939). The economic growth treadmill starts because increasing investment in the current period is required to fulfil the extra capacity created by investment in the previous time period. If investment remains the same in two time periods, there will be excess capacity, resulting in unemployment in either the capital or consumer goods industries. Unemployment leads to deficiency in aggregate demand, leading to declining investment and economic downturn. The need for growth and increased consumption arises because the productive capacity created by investment often outstrips the demand for goods and services so produced. Even allowing for population increases, according to economic theory, people simply do not consume enough to accommodate the fruits of economic activity. Keynes (Keynes, 1973) described this as a ‘fundamental psychological law’: the diminishing marginal propensity to consume (MPC) that occurs as income increases means that the proportion of income spent on consumption *decreases* as

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<sup>40</sup> “The situation where there is material economic growth but the quality of life does not increase can be defined as maldevelopment...” GALLOPIN, G. C. (2003) A systems approach to sustainability and sustainable development. Santiago, Chile, United Nations Publication. P20

<sup>41</sup> “...Sir Roy Harrod in 1940 began the process, brought to fruition by many theorists in the 1950s, of putting the stationary state into motion. The long-run equilibrium of the system became a path of steady growth, and the tools of comparative statics could then be applied to alternative growth paths rather than to alternative stationary states. ... The theory conceals, either in aggregation or in the abstract generality of multisector models, all the drama of the events -the rise and fall of products, technologies, and industries, and the accompanying transformations of the spatial and occupational distribution of the population.” NORDHAUS, W. D. & TOBIN, J. (1973) Is Growth Obsolete? IN MOSS, M. (Ed.) *The Measurement of Economic and Social Performance, Studies in Income and Wealth*. 509-510

income increased. This leads to deficient aggregate demand for goods and services as a nation becomes more affluent. The policy prescription is to stimulate aggregate demand in times of downturn – priming the pump is used as a metaphor – so that demand is maintained. Economic policy is a process of applying the correct stimuli and constraints to maintain appropriate rates of expansion necessary to maintain stability, optimality and equilibrium. Non-government stimulation of demand to ensure growth comes from advertising and strategies for planned obsolescence. Of course, both of these create waste and are not compatible with sustainability, but they are necessary for economic stability. Therein lies the incongruence.

As well as resource waste and depletion, the diseconomies of overconsumption – such as declining health – are not considered in accounting structures used to create policy. Nor is the capacity of ecosystems to absorb waste considered in economic calculations. The notion that increased consumption derived from economic growth is the source of wellbeing is challenged by Hamilton (Hamilton, 1998a, Hamilton and Denniss, 2005, Hamilton and Ruta, 2006) and others (Ackerman, 2004b, Anielski, 2000, Clark, 1991a, Daly, 1971). E.F. Schumacher (Schumacher, 1976) describes “Buddhist Economics” as an alternative approach to a consumer-based economy.

The critical issue is that there is no capacity for activity to level off in the neoclassical growth model: a reduction in demand reduces the incentive to invest, which further reduces demand causing economic activity to spiral downward. Non-growth causes economic decline. Economic stability is maintained only through economic expansion. This is the conceptual source of the fundamental lack of symbiosis between economics and sustainability. There can be no economic stability without economic growth in the neoclassical economic analytical framework.

The anomaly is that, in the earth’s biosphere, nothing expands forever. It is now known that the earth is a finite planet – this was not common knowledge in the 18<sup>th</sup> and 19<sup>th</sup> centuries when the basic principles of modern economics were

conceptualised<sup>42</sup>. It follows that neoclassical economics is incommensurable with biophysical reality; expansionism is not a viable policy approach because there are finite limits for life on planet earth; policies derived from that framework will be inherently non-sustainable.

These iatrogenic legacies of the neoclassical economic approach arise because issues are analysed in terms of optimality and equilibrium within a framework of ideal types and conjectural abstractions. However, complex systems – such as the biosphere of the planet earth – do not have ‘optimal’ conditions: there may exist conditions that are preferable for humans, but a complex system exists and functions according to its own parameters and agent behaviour. Systems have dynamic properties, attributes and conditions that exist in relation to the overall whole, not in relation to any particular agent within the system. Complex systems have interconnected structures that are characterised by emergent properties and non-linear relationships that cannot be understood by aggregating the agents or units within the system<sup>43</sup>. The properties of a system cannot be understood by analysis of the properties of the parts (Hartzog, 2011). Clark (Clark, 1991b) explains that

*...ecologists have long recognized that ‘equilibrium’ is a poor term for describing ecosystems, that in fact they are constantly evolving, past rates of climate-induced change have been on the order of hundreds to thousands of years, not the decades foreseen for the coming greenhouse effect. p411*

Therefore, optimisation is not a concept that can be applied to complex systems; there is no point of view from which a system can be deemed to be optimal at any

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<sup>42</sup> An 18<sup>th</sup> century dream was “... that there was a tree of Life in Paradise (breadfruit) that gave food without work” DENNING, G. (1992) *Mr Bligh's Bad Language: Passion, Power and Theatre on the Bounty*, Cambridge, Cambridge University Press. that could be realised by the “... discovery that the environments of distant places could be exploited for the sake of genteel living at home” DENNING, G. (1992) *Mr Bligh's Bad Language: Passion, Power and Theatre on the Bounty*, Cambridge, Cambridge University Press. P12-13.

<sup>43</sup> “... in engineering design, it is generally the rule that optimising the performance of each subcomponent of a system does not necessarily lead to the best system performance. Because of interactions between components, virtually all systems of interactive components are greater than the sums of their parts....it is all the more likely to be true for systems as fuzzy as are the short-term components of long-term economic life. c.f. Tragedy of commons.” DUMAS, L. J. (1986) *The overburdened economy : uncovering the causes of chronic unemployment, inflation, and national decline*, Berkeley, University of California Press. P33



point of time<sup>44</sup>. Different distributions of resources and activities of agents within a system will result in situations that may or may not be optimal from a particular perspective.

Nevertheless, neoclassical economic analysis is framed in terms of optimality and equilibrium and the conclusions derived are applied to complex issues *as if* this analytical approach held true for complex systems. The problem is that the focus on equilibrium and optimality within an abstract ideal-type construct leads to policy prescriptions of continuous expansion. This is an iatrogenic outcome caused by malframing issues within an inadequate analytical framework. To continue using this approach to formulate policy is to perpetuate sustainability issues. Because of these iatrogenic policy outcomes, neoclassical economic analysis is inappropriate for sustainability policy.

The shift towards sustainability policy means moving away from abstract neoclassical economic analysis. This requires more than the economic reforms usually suggested, such as de-regulation or pricing of non-market goods to correct market failure. The crucial issue is that the analytical framework is creating iatrogenic outcomes. The changes need to bring about effective sustainability policy require this fundamental issue to be addressed. Such changes require conceptual, cognitive, ontological and epistemological adaptation because a different worldview is needed to underpin the analytical framework. The sorts of changes involved are discussed in chapter eight.

### **5.6.2 Complexity exposes Pareto Efficiency as a simplistic construct**

A Pareto Optimum is described as a condition where no change can be made without making someone worse off. Arrow (Arrow, 1972) provides the standard neoclassical economic definition:

*An allocation of resources is Pareto efficient (or Pareto optimal) if there is no other feasible allocation which will make everyone better off (or, as more usually stated, make everyone at least as well off and at least one member better off). Then, by an argument that I shall sketch shortly, it was held that a competitive equilibrium necessarily yielded a Pareto efficient allocation of*

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44 That is not to say that some situations may be preferred to others; it is merely saying that the notion of an optimal condition in a dynamic system is not valid because a complex system is always changing.

*resources. It was, of course, recognized, most explicitly perhaps by Bergson, that Pareto efficiency in no way implied distributive justice. p111*

The interesting qualifications of this powerful concept are “...not other feasible allocation....” and “...at least one member better off”. It begs the question as to who decides the feasibility of the allocation, and who decides who is better off, and according to what criteria are they better off? At this point, neoclassical economists defend their argument with claims about abstract analysis providing clarity for real world situations, etc. However the tacit power of the Pareto perspective as an inhibitor of sustainability principles such as social justice, inter- and intra-generational equity are assumed to be part of economic reality: Arrow (Arrow, 1972) ends with the quip that belies the myopia of his perspective on the role of economics as a social science:

*An allocation of resources could be efficient in a Pareto sense and yet yield enormous riches to some and dire poverty to others. p111*

The Pareto Optimum (McLure, 2001) is a subtle but powerful concept that is not commensurable with disciplines: economists ignore sociological and psychological aspects by implying that poverty has no relative dimensions. It assumes that hypothetical monetary compensation can explain optimality because compensation doesn't actually have to be made, it only needs to be *possible* that it *could* be made. Pareto optimality inherently supports the status quo because it covertly accepts the existing distribution of income as the benchmark from which efficiency is calibrated. Consequently, it inhibits income redistribution as a policy tool. Thus movements towards the sustainability principle of intra-generational and inter-generational equity are regarded as conflicting with the principles of the Pareto Efficiency and therefore conflictual with economic efficiency. That it is even considered to be a basis for argument is astounding.

Awareness of complexity challenges the authority and usefulness of Pareto framework. As Bromley (Bromley, 2007) explains, it exposes Pareto-based prescriptions as being “whims of the analyst's imagination”:

*...Complexity denies to us the necessary clarity about whether or not the economy, at the moment, is in a Pareto optimal state. If it is not in such a*

*state, then **confident prescriptions about Pareto—improving policy changes are whims of the analyst's imagination and not to be taken seriously.** Complexity does not deny us the opportunity to seek ways to improve the future. Complexity merely forces us toward greater modesty in dispensing prescriptive certitudes that become the basis for policy path dependence. p679 (My emphasis)*

Without the possibility of optimality, there can be no ‘close to’ or second best (Lipsey and Lancaster, 1956-57). To paraphrase Bromley (Bromley, 2007), you can’t have a second best if you don’t know what is first best <sup>45</sup>:

*Complexity denies to us the essential tractability and predictability we need in order to advance tendentious Paretian prescriptions about what is optimal to do in the realm of human action. Models of optimality bring nothing compelling and necessary to the realm of human action—either for individual action or for collective action. (Bromley, 2007) p679*

Bromley (Bromley, 2007) gives an example of the way neoclassical economics masks amoral thinking by taking the distribution of income as a fixed parameter:

*... if clean water or air (or a preserved wetland) cannot muster a sufficient willingness to pay on the part of those who find such settings compelling, then it is said to be socially efficient that the air or water remain dirty (or the wetland be drained). It will then be asserted that there is no market failure in such cases since the costs of change are claimed to exceed the benefits of that change. In the artful terminology of environmental economics, interference with others in the form of costs shifted on to them (pollution, or a wetland turned into a suburban mall with an over-ample parking lot) that is not worth correcting is regarded as a Pareto irrelevant externality... p676*

According to Pareto Efficiency, sustainability policy has economic legitimacy so long as it does not change the economic structure.

### **5.6.3 Legacy of inadequacy: sustainability and jobs jobs jobs**

The slogan of ‘jobs, jobs, jobs’ has become a catchcry of many politicians as the criteria for responsible economic management. This slogan is based on the presumption that the material wellbeing that follows from having a job is the key to happiness and quality of life. However, it does not distinguish between gainful employment – in the sense of human development and enrichment – and activities that merely provide income for consumption. Thus a ‘jobs, jobs, jobs’ approach

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<sup>45</sup> “The well-known theory of second best seems reassuring in that while we may not be able to get the first-best outcome, the second-best outcome might still be worth pursuing. The obvious problem is that in the absence of clear guidance about first-best policies, the rest of them are incapable of being positioned or ranked.” BROMLEY, D. W. (2007) Environmental regulations and the problem of sustainability: Moving beyond “market failure”. *Ecological Economics*, 63, 676-683. p679

could theoretically achieve the full employment objective by having half the population dig holes and the other half filling them in. Or as Paul Street wrote: 'Slaves had jobs too' (Street, 2004). The point is that a sustainability-informed approach to economics allows qualitative aspects of employment to be incorporated into analysis. 'Good, worthwhile, enriching, meaningful (GWEM) jobs' would be my preferred slogan! Lifestyle is important. Having the capacity to choose when and how much to work is a positive legacy of industrial and post-industrial development. However, without a more up-to-date economic discourse, policymakers resort to 19<sup>th</sup> century interpretations of work as an experience of disutility. There are now other perspectives available on what work can be (Watts, 1951). Unless we take advantage of the fruits of industry and technological advance and integrate it into a less busy lifestyle, we are being disrespectful to the efforts of our ancestors and the sacrifices they made. The protestant work ethic (Weber, 1959) need not be the mainstay of socio-economic approaches to work. Lowe (Lowe, 2009) is advocating ideas of dematerialisation and favouring quality rather than quantity of growth. It is suggested here that claiming the power over employment and conceptualising it as a source of individual enrichment is the way in which the quality of life and dematerialism can both be achieved.

The 'jobs, jobs, jobs' approach of neoclassical economics uses employment to maintain economic stability regardless of the socio-cultural or environmental consequences. It obfuscates the management challenge of economic policy: having a free enterprise system in which resources are allocated to the work that needs doing would be a more enlightened approach. It is a challenge because, on one hand, there are tasks that need doing (e.g. cleaning up toxic waste sites) in which the urgency of action means that activity cannot be left to market forces. On the other hand, the idea of forced labour is anathema to the western liberal democratic tradition – as well as being demonstrably inefficient (Eltis, 1987). A market system that is framed within a sustainability-informed ontology may achieve such outcomes. Aspects of such an approach are discussed in chapter 11.

#### 5.6.4 Professional integrity

Finally, there is the question of professional integrity among economists. This is part of the 'shoddy' aspect of neoclassical economics to which Frow (Frow, 1992) was referring. However, given the importance of the imperatives for sustainability, the viability of ongoing, unquestioned use of the neoclassical economic *modus operandi* for sustainability policy needs to be considered.

A single but significant example is presented: In 1951, Kenneth Arrow (now Sir Kenneth) published an article called "Social Choices and Individual Values" (Arrow, 1951) in which he proved the *impossibility* of "... aggregating the preferences of individuals into a single combined order of priorities for society as a whole" (Moore, 1999) p68.

Yet, in his important ground-breaking 2006 work on "The Economics of Climate Change", Stern (Stern, 2006) makes the assumption that

*The objective of policy is taken to be the maximisation of the sum across individuals of social utilities of consumption. Thus, in this framework, **aggregation of impacts across individuals using social value judgments is assumed to be possible.** p33. (My emphasis)*

In other words, although Arrow *proved it to be impossible*, Stern nevertheless assumes that it *is possible*, so that his neoclassical economic analysis can proceed. The focus shifts to analysis of market failure, but it is on this methodological assumption that conflicts with proven economic theory that the whole economics of climate change argument is built. The question is, I suppose, does it matter that the highly abstract proof is assumed to not be a valid proof? Arrow (Arrow, 1972) referred to his proof as a paradox with unclear implications, and expressed hope in his Nobel Prize lecture that "others would take this paradox as a challenge rather than as a discouraging barrier" p130.

At one level, the issue that concerns me is the professional integrity of the economics discipline in which, on one hand, highly abstract mathematical analysis is used to prove a certain position, and, on the other, another extensive analysis of market failure is based on the assumption that the proof did not hold. However, at another level I am disturbed that this type of analysis is being used as the policy

framework for dealing with the profoundly important issues of greenhouse gas emissions and climate change.

### **5.7 Policy implications: The myopia of market failure analysis**

Neoclassical economists focus on pricing strategies on the assumption that, if accurate prices can be ascribed to non-market and intangible goods and services, then market forces will pull the external diseconomies into their orbit and economic policy will achieve appropriate and optimal outcomes for managing sustainability. However, as O'Connor (O'Connor, 2002) explains

*Often the demand for taking the environment into account is for valuation in monetary terms. This allows environmental impacts and protection questions to be formulated as optimal resource use problems through the extension of traditional cost-benefit analysis techniques. ... there is a need for decision support techniques that do not depend exclusively on monetary valuation, such as multicriteria and deliberative methods p34*

The misconception is that monetisation provides 'hard data' that is irrefutable because it is:

*... in a language which carries more weight in public debate in capitalist societies than moral abstractions such as 'goodness': the language of money. (Gleeson-White, 2011) p244*

The presumption is that 'hard data' of monetisation over-rides other value frameworks:

*...once you have the methodology to equate trees with dollars, now you're talking. It's no longer about hugging trees because they're good, but because you have hard data in a language more effective in the public dialogue' NY Park Department's chief of forestry and horticulture (Gleeson-White, 2011) p241*

This over-estimates the power of economics, and reflects a myopic approach within the self-referential, non-reflexive neoclassical economic framework. As O'Connor (O'Connor, 2002) explains:

*.. apart from scientific uncertainties about economic and ecological evolutions, there are also irreducible social obstacles to specification of opportunity costs in monetary terms, linked, for example, to notions of rights to life or property for other people or other species; to people's individual and collective sense of the sacred; or to natural or built features that are paramount matters of local identity. p40-41*

Distillation of values into monetary units causes issues to be malframed and leads to unhelpful policy suggestions. It parallels the fruitless activities of alchemists trying to isolate phlogiston and unlock the secrets of transmutation of elements into gold: wrong framework, wrong questions, wasted time. As Ackerman and Heinzerling (Ackerman and Heinzerling, 2004) explain:

*The basic problem with narrow economic analysis of health and environmental protection is that human life, health, and nature cannot be described meaningfully in monetary terms; they are priceless... Cost-benefit analysis of health and environmental protection rests on simplistic, implausible hypotheses about the prices that would prevail if priceless values were to show up next to the lettuce on the supermarket shelf. A different method of analysis and comparison is needed to separate good policy proposals from bad ones, a method that does not pretend that a mathematical formula can solve our problems for us. p7-11*

The monodimensionalism of monetisation processes needs to be augmented by qualitative, multidimensional data in the accounting system. O'Connor (O'Connor, 2002) explains that a combination of uncertainty, social justice and equity issues expose

*...the difficulty or inappropriateness of monetary valuation... In such cases there is a need for decision support techniques that do not depend exclusively on monetary valuation, such as multicriteria and deliberative methods.... p34*

#### **5.7.1 The creation of purchasing power and its validation for use in a market economy**

The nature of money as an entity and the way transactions are undertaken in the modern financial system is little understood. A realistic definition of money nowadays is whatever is accepted as money. This works so long as it works and is accepted: For instance, when providing money to bail out sovereign debt, the actual resolution is executed as an electronic transfer of funds, merely an accounting entry. This is not to say that funds do not exist, and that they are not powerful in the market place. But it is sobering to witness the escalation of financial debt generated by an economic system based on abstractions that defy the laws of physics and its power to command resources without regard to the biophysical limits by which life on earth is perpetuated.

There have been many financial crises (Poovey, 2003b, Gleeson, 1999) from which economies have recovered. However, the difference now is twofold: firstly, the

unintended consequences of economic expansion are impacting on the capacity of neoclassical economic policy to respond to financial crises. The capacity to create debt has outstripped the ability to manage it. The myopia of neoclassical economics keeps attention on pricing solutions to climate change issues. Secondly, the self-referentialism of the discipline keeps the attention of policymakers away from the non-price aspects of climate change. In particular, they ignore the impact that climate change has on the insurance industry and the implications of those impacts on the financial sector. The insurance industry is the one part of the financial sector that does interface with biophysical limits and socio-cultural reality. Yet, the significance of the insurance issues remains buried below explanations of the GFC as being a credit crisis triggered by banking a failure in lending to sub-prime borrowers. This is despite the fact that the American Insurance Group received the largest bail out funding in the US post 2008, and the fact that the insurance crisis precipitated the credit crisis, the simplistic interpretations of rogue traders and irresponsible borrowers remains the basis for explanation of what happened.

Neoclassical economists have forgotten, or choose to ignore, the fact that a market economy needs the ability to establish the validity of the money being offered as purchasing power in the market place. The issue of counterfeiting notes and coins is still acknowledged, but notes and coins are used in only a small fraction of market exchanges. The main source of purchasing power in modern economics is from privately owned banks and financial institutions that use incredibly sophisticated methods to create financial instruments for trading on global financial markets. For instance, financial instruments known as derivatives are used to generate extensive purchasing power without any productive effort. As Poovey (Poovey, 2001) explains:

*In the new finance economy, ever-more complicated derivatives and the development of speculative strategies designed to take advantage of opportunities that disappear as soon as they are visible link increased value to decreased temporal outlays and to decreases in actual capital outlays as well. Risk, speculation, volatility, and speed thus create a treadmill effect that resembles the treadmill effect of the old economy, but in a new form. p414*

The lack of capacity to validate money and financial instruments reflects the fact that no distinction is able to be made between real and imagined economic activity



in the modern accounting system. All values are derived from monetised market prices. There is no process by which economic values can be tethered to the other layers in which sustainability issues, and viability, need to be considered.

Richardson (Richardson, 2002, Richardson, 2006, Richardson, 2008) argues for reforms to the financial system by which responsibility for environmental and other outcomes are appended to the financial institution that provided the finance for such investments. That is, financial institutions should be held responsible for economic externalities created by the loans they make, and that they should be included in anti-pollution regulation and policy. In other words, that sustainability policies need to include other than end-of-pipeline polluters.

Changes of this nature may seem a huge conceptual leap for policy makers, but they are already in practice in some non-neoclassical economic banking systems. For instance, responsibility for outcomes of investment (positive and negative) is a feature of Islamic economics and finance (Hassan and Lewis, 2007, Kettell, 2010, Maurer, 2005). In addition, cooperative structures developed in the 19<sup>th</sup> century have mechanisms that ensure that capital is used for the benefit of members' enterprise and wellbeing, not for speculative gain. Shares in the cooperative enterprise structure increase in value as the overall value of economic activity increases; that is, value increases as a return for effort. This contrasts with value increases arising from speculations on the market value of the shares, regardless of the economic activity being undertaken.

Managing climate change through the price mechanism also ignores the basic question as to the efficacy of the market operations for dealing with complex issues, or the efficacy of market failure as an analytical tool (Bromley, 2007). The fact is that climate change is not a simple economic issue of market failure. There are many dimensions involved and a grasp of complexity theory is needed to properly understand the aspects involved.

It is the use of money that differentiates the price mechanism of the market from a barter system. A complete analysis of market operations needs to consider what constitutes a valid currency; how that currency is created, by whom and by what

authority; what cultural significance and powers it has, and how it is distributed. Financial and money market activities have a significant role on climate change issues because the purchasing power they create has the capacity to consume carbon even though it was derived entirely within the abstract world of modern money and finance. The issue is on what basis does such purchasing power attain legitimacy and validity for use within the market?

The neoclassical economic approach focuses on the price mechanism of market functioning. Market failure is used to describe unintended consequences or negative externalities. Complex issues exist because they are outside of the market; they are resolvable by pricing policies and de-regulation of markets. This has led to a myopic perception of complex sustainability issues among neoclassical economists, and, therefore, in conventional policy processes. It is myopic in two ways: firstly market failure analysis is the standard framework for addressing problem issues. Secondly, the emphasis on pricing de-emphasises other aspects that may be inhibiting the effective operation of the market. This is evidenced, for example, by the fact that both Garnaut's (Garnaut, 2008) and Stern's work (Stern, 2006, Stern, 2009) on the economics of climate change use the pricing aspect of market failure to address the issue, but they also *ignore the role of the financial sector* and the impacts that the creation of purchasing power has on market function in their analysis<sup>46</sup>. The financial sector provides a significant amount of the purchasing power that is exercised in the market operations, so the quantity of purchasing power that is generated is relevant to climate change because market purchases lead to greenhouse gas emissions. Creation of purchasing power leads to increased demand for goods and services which leads to greenhouse gas emissions and climate change.

The issue is that, in the modern economic system, the capacity to create purchasing power has become so sophisticated that it has outstripped the capacity of biophysical ecosystems to adapt or absorb waste, or for resources to be renewed.

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<sup>46</sup> Garnaut's GARNAUT (2008) Garnaut Climate Change Review: Interim Report to the Commonwealth, State and Territory Governments of Australia. Canberra, Australian Government. simplified approach to risk and uncertainty is described above.

The myopia of neoclassical economists creates malpolicy because they remain focused on the pricing aspects of market failure and ignore completely the role that financial institutions play in creating purchasing power that is exercised in the market, and from which greenhouse gases are emitted. As Richardson (Richardson, 2008) points out:

*The biggest environmental impact of financiers is not their own direct ecological footprint, but indirect effects of allocating capital to the corporate sector. Financiers' capital is transformed, through scale, time, and location into an instrument of development. As corporations are rarely always financially self-sufficient, they turn to capital markets to assist growth and new investments. p5.*

The creation of purchasing power is identified as a crucial issue for sustainability because purchasing power generated *within* the abstract self-referential world of finance and speculation has the same *validity in the market place* as income derived from more substantive activities, such as cultivation for production of food. The problem arises because the capacity to generate purchasing power within the abstract domain is rapid and without limits: purchasing power derived from abstract manipulations is not tethered to an accounting narrative that includes any qualitative biophysical or socio-cultural properties or attributes. As compound interest calculations show, purchasing power derived in the abstract domain can increase exponentially as a function of time, without regard to any biophysical or socio-cultural parameters.

The ignorance of the role of finance in the economics of climate change exposes a fundamental flaw in the neoclassical economic interpretation of complex sustainability issues.

However, not everybody is myopic or asleep. Richardson (Richardson, 2008) for instance, argues that the role of financial institutions is of paramount concern:

*Sustainability demands that we recognize financial institutions' amorphous and often obscured influence, as institutions that fund and profit from projects and enterprises that sometimes injure the environment and communities... we must decipher the etiology of unsustainable development in relation to the financial sector and the companies it funds. p9*

Perhaps the ignorance arises because the extraordinary power of financial institutions is a 20<sup>th</sup> century development. The use of debt-funded investment to start an enterprise is pervasive in the 21<sup>st</sup> century, but it is a relatively new phenomenon, originating in the late 19<sup>th</sup> and early 20<sup>th</sup> century (Burke, 1991, Metin and Ward, 1977, Neal, 1990). In this 20<sup>th</sup> century economic paradigm, investment activity arises from finance capital originating within the abstract machinations of the economic system, and not from savings derived from earlier productivity. Investment in this perspective has moved closer to speculation on how share prices will move, regardless of the activity they represent. According to Hart, less than 1% of international financial transactions are to do with trade (Hart, 2001).

In summary, the omission of money and finance from the reports on the economics of climate change was a flabbergasting discovery for me. It provides further grounds for moving away from the neoclassical economic paradigm as a policy framework. Nevertheless, the reconceptualisations of economics and accounting presented later in this thesis will go some way to overcoming this grand omission from the economic perspective.

#### **5.7.2 Overcoming growthmanship: the intransigence of neoclassical economic growth theory**

The folly of economic growth is well publicised (Jackson et al., 2008). Lowe (Lowe, 2009) suggests that the myth that 'growth is good' is very deep-seated in our society and challenging it is tantamount to heresy. This leads to the outcome that benefits of growth are acclaimed and costs ignored (p74). Durant (Durant et al., 2004) explains how unbridled economic expansion is known to pose threats in the face of limited natural resources and fragile ecosystem functions. He calls for a "new central animating principle" of environmentally sustainable economic development.



(Jackson et al., 2008)

There have been many other calls for changes in the way policymakers address the dynamics/processes and behaviours perpetuating sustainability issues. Modvar and Gallopin (Modvar and Gallopin, 2005) comment that the need for change has been officially recognised by the United Nations for at least two decades: first at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro and then at the World Summit on Sustainable Development in Johannesburg in 2002 (p23).

The issue is not information about the effects of unbridled economic growth, but how it might be turned around when such a move is counter to entrenched cultural mythology and easily interpreted as threatening modern lifestyles.

The change process is complicated because economic efficiency is not only the predominant policy objective, but it also over-rides, or at least overshadows other issues and aspirations that guide human behaviour “such as solidarity, community, equality, or friendship” (Wolff and Haubrich, 2006) p748.

## 5.8 Conclusion

Neoclassical economics interprets sustainability to suit its analytical and methodological framework. It arrogates the sustainability concept so that it will fit into this framework and thereby perpetuates the notion that sustainability is essentially an economic issue resolvable with economic growth and market reform.

Neoclassical economics is not framed with an adequate concept of complex reality.

The use of highly abstract analysis and methodologies causes issues to be malframed from which policies are prescribed that produce iatrogenic outcomes. The economic expansion required for the conditions of equilibrium and optimality described in the abstract analysis exacerbates sustainability issues.

The malframing of issues and self-referentialism of the neoclassical economic framework cause complex issues to be approached simplistically and without any commensurability with other scientific understandings. Malframing and self-referentialism cause myopia within the discipline so that issues have to be dealt with using the neoclassical economic tools and perspectives. Furthermore, fundamental prerequisites for economic efficiency, such as ensuring the validity of currency that underpins purchasing power in the market, are forgotten or overlooked. The creation of purchasing power and its capacity to consume resources is a crucial issue for sustainability policy.

Lastly, the integrity of the neoclassical economic discipline is exposed when proofs established by its own methodologies within its own self-referential abstract framework are casually over-ridden, without question, by an assumption that the proof does not hold, in order to facilitate analytical convenience.

From a sustainability perspective, the legitimacy of the neoclassical economic conceptual framework, and the methodological integrity of some key analysts in the economics discipline, suggest that the appropriateness of neoclassical economics as the principal policy framework for addressing sustainability issues is questionable.

In the next chapter aspects of the relationship between sustainability and neoclassical economics are examined and discussed.

## Chapter 6: The interface between neoclassical economics and sustainability

### 6.1 Introduction

In this chapter, the relationship between sustainability and neoclassical economics is discussed.

Framing the relationship between sustainability and neoclassical economics as an *interface* allows the adequacy and competence of the two approaches to be assessed in terms of the complex issues needing to be addressed.

The adequacy is discussed in terms of conceptual similarities and differences, and how they relate to other scientific understandings. The interface is examined for evidence of symbiosis, synergies, and compatibilities. The two conceptual domains are examined for anomalies<sup>47</sup>, incongruence and incommensurability.

The aim is to establish to what degree sustainability and neoclassical economics are symbiotic; whether or not reform processes could heal any rifts; and, if not, which domain has the credibility and legitimacy to have the prerogative for framing policy<sup>48</sup>.

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<sup>47</sup> ‘...anomalies reveal that something is wrong with the structure our concepts give the world...’ ANDERSEN, H., BARKER, P. & CHEN, X. (2006) *The Cognitive Structure of Scientific Revolutions*. Cambridge, Cambridge University Press. p172.

<sup>48</sup> I have distilled these perspectives from the writers across a variety of disciplines. For example, Voss, Bauknecht and Kemp VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (2006) *Reflexive governance for sustainable development*, Cheltenham, Edward Elgar. and Kemp, Parto and Gibson KEMP, R., PARTO, S. A. & GIBSON, R. B. (2005) Governance for sustainable development: moving from theory to practice. *Int. J. Sustainable Development*, 8, 12–30. emphasise that sustainability issues emerge as the unintended consequences of modernism, Niccolucci, Pulselli and Tiezzi NICCOLUCCI, V., PULSELLI, F. M. & TIEZZI, E. (2007) Strengthening the threshold hypothesis: Economic and biophysical limits to growth. *Ecological Economics*, 60, 667-672. and Norton NORTON, B. G. (1991) Ecological Health and Sustainable Resource Management. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press. demonstrate that there are limits to biophysical capacity, Diamond DIAMOND, J. M. (2005) *Collapse : how societies choose to fail or succeed*, New York, Viking. and Ponting PONTING, C. (1992) *A green history of the world*, London, Penguin. emphasise the existence of limits to economic expansion, Stern STERN, N. H. (2009) *A blueprint for a safer planet : how to manage climate change and create a new era of progress and prosperity*, London, Bodley Head. and Knetsch KNETSCH, J. L. (1994) Environmental Valuation: Some Problems of Wrong Questions and Misleading Answers. *Environmental Values*, 3, 351-368. and Young YOUNG, M. D. (1993) *For Our Children's Children: Some Practical Implications of Inter-Generational Equity and the Precautionary Principle*, Canberra, Australia, Resources Assessment Commission, Australian Government Publishing Service. discuss the problems with the use of discount rates as a basis for viability calculations, and Poovey POOVEY, M. (2004) For what it's worth. *Critical Inquiry*, 30.2. describes the implications and historical context of

## 6.2 Background: Literature review of economics and environment relations

There have been many pioneering works on the relations between economics and environment, and economics and ecology – for example (Folke and Kaberger, 1991, Costanza et al., 2001a, van der Straaten, 1994, Alcamo et al., 2003, Andersson et al., 1995, Ayres, 2001, Beltratti, 1996, Bohlen, 1996, Georgescu-Roegen et al., 1999, Ruth, 1993).

There is an abundance of literature and variety of approaches proposed to reform economics and make it more ‘environmentally friendly’ (Clark, 1991a, Mofid and Szeghi, 2010, Opschoor, 1994). The main focus is on improving market efficiency by better pricing of environmental services (Hamilton, 1993, Serafy, 1991, Ulanowicz, 1991, Zylicz, 1991); there are also calls for more ethical considerations of environmental aspects (Spash, 1999, Spash et al., 2005, Hamilton, 1998b, Steiner, 2002, Zweer, 1994, Kellert and Bormann, 1991).

## 6.3 The conceptual conflicts between sustainability and neoclassical economics

The incommensurability of sustainability concept with neoclassical economics is discussed in terms of the following conceptual issues:

1. Unintended Consequences
2. The existence of biophysical and socio-cultural limits
3. The methodological assumption of *ceteris paribus* (other things being equal) conflicts with the basic tenets of complexity theory.

There are two interpretations of commensurability<sup>49</sup>. The first is the notion that different items have common or related properties that allows them to be grouped and operationalised as a single unit; that is, to be quantified. As discussed

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Hobbes’ assertion of functional equivalence and its legacy of quantificationism. Strauch provides a critique of quantitative method STRAUCH, R. E. (1974) A Critical Assessment of Quantitative Methodology as a Policy Analysis Tool. *Rand Corporation Papers*. Santa Monica, California..

49 Commensurability is different to commensuration: that is, the assumption that the essence of all things, or even ideas-of-things, can be adequately represented by ascribing an algebraic or numerical value to an item. The tacit assumption is that the numbers so ascribed can be validly and meaningfully manipulated according to mathematical laws. Use of number systems as objective symbols, and the process of abstraction are closely related.



elsewhere in this thesis, the assumption of commensurability *within* the neoclassical economics framework is problematic for sustainability because diversity and complexity are essential aspects of the sustainability concept. The emphasis on quantification in the neoclassical economics approach provides faux certainty in analytical outcomes, and the neglect of qualification in the neoclassical economics approach contributes to the inadequacy of the analytical approach because complex issues require normative interpretation, not merely quantification.

Commensurability is used to describe the consistency and logical coherence that exist *between* epistemic paradigms or systems of thought; that is, the relationship between economic analysis and other sciences. Conflicts or lack of coherence between paradigms is called incommensurability and it represents a dissonance between disciplines. The basic tenet of science is that all disciplines need to be commensurable for knowledge to have integrity. Conflicts between paradigms indicate the need for further clarification, research and, perhaps reconceptualisation within one or more disciplines.

The notion of incommensurability between different scientific paradigms is attributed to Kuhn (Kuhn, 1970, Kuhn, 1987, Wray, 2007a, Wray, 2007b). However, as Andersen, Parker and Chen (Andersen et al., 2006) explain, Kuhn adapted his concept of incommensurability over time:

*... Kuhn denied that his concept of incommensurability was total or that he had claimed total communication failure between supporters of successive paradigms... To preclude further misunderstandings, [Kuhn] dropped references to gestalt switches and the visual consequences of scientific revolutions. In their place he developed the account of the relations between incommensurable concepts begun in 'The Structure of Scientific Revolutions'. He now suggested that the communities of scientists supporting rival paradigms are like different linguistic communities. The question of the extent and nature of incommensurability could then be addressed by analogy with questions of the extent and nature of translation between natural languages. Incommensurability now became a failure of translation, which naturally limited its scope... It became plausible to confine the source of untranslatability to a particular problematic topic or activity while acknowledging that it might be possible to produce perfectly adequate translations between the same pair of languages in connection with many other activities. In this way, Kuhn made plausible his suggestion that although successive paradigms might be incommensurable in some aspects, enough common features would remain to*

*allow a basis for communication between communities supporting them and possibly furnish a basis for some form of appraisal. p106.*

The need for commensurability between disciplines or approaches is a fundamental aspect of modern science insofar as conclusions and methods need to be transferrable across disciplines. Somehow, neoclassical economists see themselves not bound by this parameter.

There are three aspects of incommensurability:

### **6.3.1 Unintended consequences**

Smith (Smith, 2006) describes unintended consequences as

*...actions [that] create consequences other than those which are explicitly intended. ... There are both benign and malign unintended consequences. p10*

The role and perception of unintended consequences is different – oppositional – in the neoclassical economics and sustainability perspectives.

Voss and Kemp (Voss and Kemp, 2006) explain the significance of unintended consequences for sustainability analysis:

*Since the problem of sustainable development is one of unintended side-effects, different perspectives that specialise in particular aspects of the world such as economics, politics, culture, technology and ecology need to work together to define problems and perform analysis without exclusions. This refers to both the involvement of different scientific disciplines and the participation of actors from other subsystems of society. Problem definition and analysis for promoting sustainable development must be based on integrated knowledge produced in relation to the relevant perspectives. p18*

In a sense, the sustainability concept was developed as a response to the ‘unintended consequences of modernism’. Beck (Beck, 2006) describes the transition from industrial (first) modernity to risk modernity as:

*...one which occurs unintentionally, imperceptibly and obligatorily, in the course of a process of modernization. It is characterized by latent side-effects, which have their own independent dynamic. (e.g. climate change is an unintentional side effect of modern progress). p34-35*

The differing perceptions of unintended consequences expose a fundamental incommensurability between sustainability perspectives and that of neoclassical economists. The neoclassical economics approach is that unintended market

outcomes are part of the optimisation processes by which sustainability issues are ultimately resolvable; in the sustainability approach, unintended consequences describe the nature of the issues needing to be resolved, and to which policy needs to be directed. From a sustainability perspective, issues created by unintended consequences are threatening the planet; from a neoclassical economics point of view, unintended consequences are best dealt with by extending and reforming market mechanisms. Neoclassical economists argue that this will result in optimum allocation of resources, provided the operation of the 'invisible hand' is not inhibited by regulation or other constraints on the market mechanism. This is to put great faith in the notion that 'self-organising' systems do so in a way that suits the wants and needs of humans. As Brady (Brady, 2005) states:

*The argument, ultimately, is that sustainability proponents can no longer avoid facing the far-reaching political character of this transition – that enabling individuals and peoples freely to meet their needs in an equitable, ecologically sustainable fashion is compatible neither with free market fundamentalism (Anglo-American neoliberalism) nor its illiberal alternatives (e.g. religious fundamentalist regimes and movements). p403*

However, the point of difference here is that Anglo-American neoliberalism is not necessarily the only version of market system available for economic organisation. As will be discussed below, sustainability needs flexibility and creativity to accommodate complexity and change. Regulation and centralised control is too slow in responding and stifling of initiative. At the same time, sustainability needs an economic framework that can distinguish between speculation and creative entrepreneurship. And as it turns out, efficient market functioning also needs to be able to distinguish the validity of money being offered as purchasing power. These differentiations are not made in neoclassical economic theory.

The neoclassical economic discourse presents unintended consequences as the mechanisms by which the market works to optimally allocate resources (Smith, 2006). The metaphor of an 'invisible hand' is used to describe how unintended consequences facilitate a spontaneous order<sup>50</sup> that self-regulates and optimises economic conditions, independently of the conscious intentions of humans, save for

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50 "...we will consider the market, often taken to be the paradigmatic example of a spontaneous order..." SMITH, C. (2006) *Adam Smith's political philosophy : the invisible hand and spontaneous order*, London ; New York, Routledge. P2

self-interest. Malignant consequences are described as negative externalities, consequences arising outside the market because of lack proper pricing and extent of market activity. Externalities are unintended consequences that can be managed by extending the breadth of the market operations through pricing mechanisms, such as applying surrogate prices. The pricing of carbon as a means of correcting the unintended consequences of greenhouse gas emissions that cause climate change is an example of this approach. Fundamentally, the neoclassical economic approach requires leaving the market to enjoy the unintended consequences of the invisible hand.

Conversely, unintended consequences are a policy challenge for sustainability. Unintended consequences arise unexpectedly and are outside of policy control. Voss and Kemp (Voss and Kemp, 2006) explain that unintended consequences are persistent because:

*... no comprehensive and exact model for the prediction of socio-ecological dynamics is possible. ... a high probability of unintended consequences needs to be assumed as an essential condition of problem-solving strategies. p12*

In a sustainability framework, unintended consequences are the unplanned legacies of complexity that occur across timeframes, scales and dimensions (Sachs, 1999).

They are not necessarily or obviously linked in an observable causal chain. As

Costanza (Costanza, 2001) explains:

*...the causes of many sustainability problems lie in 'scale' problems. Large-scale ecosystems are not simply small-scale systems grown large, nor are micro-scale ecosystems mere microcosms of large-scale systems. The driving forces and feedback mechanisms in large- and small-scale systems operate at different levels and exhibit distinct patterns. The means that management systems that produce acceptable outcomes when applied to ecosystems at one level can (and frequently do) produce disruptive or destructive results when applied to higher level or lower level systems. p7*

Unintended consequences require systemic adaptation because they fall outside of conventional scientific domains and governmental jurisdictions. They may also be outside the scope of the methodologies and practices of conventional specialist disciplines (Dovers, 2003b, Bressers and Rosenbaum, 2000). Svedin (Svedin, 1991) explains that the legacies of unintended consequences can be global and catastrophic:

*The earlier kinds of accidental events in the environment field were mostly of a local nature even if the effects at that level could be severe enough and even fatal for the unfortunate individuals concerned. The catastrophes of today - such as the Chernobyl nuclear accident - destroy vast areas for a very long time. The genetic effects over generations have so far not been estimated with sufficient certainty. The diffuseness, the size of the effects and the very long time scales of the impacts point at new serious elements in the environmental field. p15*

Unintended consequences are difficult to predict. They have profound implications for policy and require approaches that acknowledge and accommodate the complexity of issues being addressed. Beck (Beck, 2006) explains that the

*... transformation of the over-looked side-effects of industrial production into ecological crisis-breeders of global import is anything but a problem of 'the environment', of 'the world around us' alone, rather, it is a profound institutional crisis of industrial modernity, and of its typical political form of the nation state itself. p37*

Clearly the differing perspectives and interpretations of unintended consequences create an inherent dissonance between the approaches used in neoclassical economics and those used in sustainability policy formulation<sup>51</sup>. Awareness of this incommensurability means that contemporary policy makers have a clear dichotomy of perspectives for addressing sustainability issues. They represent irreconcilable cognitive differences in the relation between analysis and reality that is used to underpin policy-making. They have a choice of persisting with an abstract ideal-type simplistic framework, or moving to one that accepts the perspectives of modern science on the nature of complex issues.

### **6.3.2 Biophysical and socio-cultural limits: substitutability and functional equivalence**

There are two critical differences between the sustainability and neoclassical economics policy frameworks in relation to limits. The sustainability framework acknowledges the existence of biophysical and socio-cultural limits. In the

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51 "The intertemporal analysis of decisions in the face of uncertainty introduces an important dimension... It is irreversibility which makes uncertainty such an important issue in many fields including environmental economics. Unfortunately while irreversibility greatly increases the practical importance of a normative decision theory it prevents the utilization of the existing theories. Neither objective theories nor subjective theories are applicable to irreversible events" VERCELLI, A. (1993) *Hard Uncertainty and Environment*, Milan, Fondazione E. Mattei. P14, cited in FROGER, G. & ZYLA, E. (1998) Towards a Decision-Making Framework to Address Sustainable Development Issues. IN O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (Eds.) *Sustainable development : concepts, rationalities, and strategies*. Dordrecht ; Boston, Kluwer. P285

neoclassical economic framework, limits are not relevant because the assumption of perfect substitutability among factors of production means that resource exhaustion, or species extinction, or habitat destruction will create incentives for other resources, species or habitats to be found to take their place. It is a case where abstractionist methodologies are used to justify facile interpretations of biophysical reality.

*6.3.2.1 The existence of biophysical and socio-cultural limits to expansion.*

In sustainability approaches, limits are essential considerations. Niccolucci, Pulselli and Tiezzi (Niccolucci et al., 2007) suggest that "...economic and biophysical thresholds of growth should be understood as natural long-term limits to human activity" (p671). Kohn et al. (Kohn et al., 1999a) explain that only by accepting

*... the importance of the scale of economic activity vis - a -vis the carrying capacity of the planet, can we address the real issue of sustainability, namely that the total human impact is too great and should be reduced. If we focus only on a narrow industrial metabolism perspective, we run the risk of merely shifting waste emissions from one medium to another without reducing the total. p6*

The particular limits are:

- the capacity of ecosystems to regenerate
- the capacity of ecosystems to absorb waste
- the capacity for substitutability among or between agents within ecosystems.

The existence and relevance of biophysical limits on planet earth are not included in neoclassical economic parameters<sup>52</sup>, except when limits are breached and they impact as conditions of scarcity.

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52 "Marginal productivity theory states that an increase in an individual factor of production will yield an increase in output when all other inputs are held constant. But this assumption violates the first law of thermodynamics which dictates that a change in physical output requires (1) corresponding flows of the materials which will be embodied in output and (2) the free energy required to do the work of production. It is an unavoidable consequence of the principles of matter and energy conservation and the entropy law that positive marginal products do not and cannot exist in the real world."  
CHRISTENSEN, P. P. (2001) Early links between sciences of nature and economics: historical perspectives for ecological and social economics. IN CLEVELAND, C. J., STERN, D. I. & COSTANZA, R. (Eds.) *The economics of nature and the nature of economics*. Cheltenham, Edward Elgar. P16-17

The sustainability perspective is that to disregard these limits creates disastrous consequences – e.g. species' extinctions, desertification, or extreme climatic events. In neoclassical economics, the problem of limits is dealt with by the assumption of substitution among factors of production, and by scarcity providing a price incentive to find alternatives. When this mode of thinking is applied to non-human made items, it eradicates the notion of biodiversity, species' uniqueness, or even the irreversibility of life. Do two hippos added together equal an elephant of equal weight?

Christensen (Christensen, 2001) explains that the neglect of energy, biosphere and material flows in economics is part of the roots of neoclassical economics:

*[It]... goes back to Walras (1874) who declared that 'machines, instruments, tools ... engender incomes in the same way' that a field grows a crop year after year. But Walras neglects the fact that a field grows a crop in conjunction with flows of sunlight, water and nutrients. If any of these essential requirements are not available, output is nil according to Liebig's law of the minimum. Machines and industrial processes can only produce physical output in conjunction with available material and energy flows. Adam Smith's fixed and circulating capital are required together. They are complementary and not substitutable inputs." p16-17*

#### *6.3.2.2 Substitutability and functional equivalence among resources and agents*

Species extinctions and wasteful use of non-renewable resources are central issues for sustainability. In contrast, neoclassical economists invoke the notion that substitutes will be found if the market demands it. This represents a fundamental cognitive dissonance between the sustainability perspective and that of neoclassical economists. Spangenberg (Spangenberg, 2001) writes:

*Scientifically, it is obvious that to a certain degree substitution of resources is a common process in the co-evolution of species and their ecological niches; however, there are a number of essential resources (water, minerals, etc.) that cannot be substituted, i.e. replaced by a different but functionally equivalent item... from an ecological point of view it is quite obvious that it is not the stock of resources but the functioning of the ecosystem (i.e. its resilience and viability) that needs to be sustained. p29*

Neoclassical economics theory asserts that prudence in the use of non-renewable resources, or non-replaceable natural or cultural attributes will emerge from market forces because scarcity will cause price rises from which incentives to find substitutes will emerge. The arguments of neoclassical economists beguile policy

makers with their meta-language that implies the theoretical neoclassical economic perspectives are transferrable to real-world situations. For example, as Harris (Harris, 2007) explains:

*... Solow and Hartwick assumed substitutability between [natural and manufactured capital] and suggested that intergenerational equity was preserved if the total stock of all forms of capital was preserved, and that rents from the exhaustion of resources were invested for the benefit of future generations. p256*

This statement frames issues as if there were no entropy (all forms of capital are preserved), a universal currency that values rents (to be collected by whom?) even when resources are exhausted (this conflicts with preservation of capital stocks). It also assumes that there are means by which money collected from current rents can create benefits for future generations who do not have access to those resources. These details and qualifications are omitted from the simplistic neoclassical approaches.

The assumption of substitutability among resources, technologies and species is invoked on the grounds that new technologies can or will be able to replace ecosystem function, extinct species or depleted resources with functionally equivalent human-made goods and services (Kane, 1999) p14.

If one is to ground policy in a contemporary understanding of reality, substitutability is not a valid assumption when issues of ecological integrity, ecosystem function, and other sustainability issues, such as intergenerational equity, are aspects of analysis. The notion that '*vast substitutabilities between different forms of assets are in fact possible*' (Svedin, 1991) (p10) needs to be dismissed because it validates exploitation of the natural world and contradicts the basic premises of sustainability. Using the assumption that substitutes will be discovered or created when resources are depleted<sup>53</sup> as a basis for policy is irresponsible folly (Harris, 2007) p256.

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53 "The 'environmental Kuznets curve' is a form of economic reasoning that says that it is possible to destroy or pollute the environment when a country or region is poor. Trade and development improve the environment through increased income, because richer people can afford to fix up the environment later. Substitutability between manufactured and natural capital is not possible if hysteresis and



### 6.3.2.3 *The Assumption of Ceteris Paribus*

Economists use the assumption of '*ceteris paribus*': i.e. other things being equal to analyse the effect of changing just one, or a few variables while the others are held constant. This assumption misconstrues the dynamic, adaptive and non-linear attributes of complex systems. Therefore, analysis that uses this assumption is not applicable to complex situations. It is not meaningful or analytically legitimate because in a complex adaptive system variables cannot be held constant while the behaviours of others are analysed.

## 6.4 Incongruence of sustainability and neoclassical economics

### 6.4.1 The significance of the future: amenity for future generations

Incongruence between sustainability and neoclassical economics arise because sustainability-oriented policy is about enhancing the future, whereas neoclassical economics viability is based on a discounted value of the future. In the neoclassical economics framework there is no acknowledgement of the needs of future generations. Their exclusion from the market place is ignored by neoclassical economics theory through approaches such as the discount rate, opportunity cost, market failure and aggregability.

#### 6.4.1.1 *The discount rate*

The discount rate is an equation used to ascribe a future value into present-day values. The equation is called Net Present Value (NPV). These Net Present Value (NPV) calculations are used in cost-benefit analyses to compare options and calculate viability. The discount rate may be described as a reverse of the compound interest formula that is used to calculate a personal loan or mortgage. Instead of the amount growing into the future, the amount of the future value decreases. It is a calculative process by which the value of resources to future generations is diminished in favour of their value to the present generation. A discount rate greater than zero has the affect of allowing the amenity of future generations to be dispossessed; it is based on the notion that the values and needs

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thresholds render change irreversible." HARRIS, G. P. (2007) *Seeking sustainability in an age of complexity*, Cambridge, Cambridge University Press. P255

of future generations are less than that of the present generation. It is a methodology that facilitates exploitation and wasteful use of resources.

Young (Young, 1993) gives an example of the power of the discount rate:

*A discount rate of 3% assigns a present value of \$307 to the same resources that would be valued at \$1000 in 40 years. p24*

That is, by using a discount rate of a mere 3% the value of resources to the next generation (just 40 years hence) is calculated to be less than half the value to the present generation. A mere 3% reduces the value in 40 years to just over 30%. In practice, the discount rates are often much higher; for instance, in New South Wales the "... Treasury currently directs use of a 7% real discount rate in economic appraisal (cost-benefit analysis). The Victorian Government directs use of a 6% real rate..."(Executive Manager, 2010).

A discount rate greater than zero means that it is less rational to save. Without savings, the capacity to invest is reduced. Using a negative discount rate would mean that, to establish viability, a project would have to demonstrate how it could add to, or enhance the future in ways other than the self-referential criteria of more economic expansion. A negative discount rate would mean many economic activities would be no longer viable as per the current mode of calculation. A broader sustainability policy framework would be needed in which entrepreneurs were encouraged to be creative and invest in activities that enhance the future, rather than being constrained to do so because of the discount rate viability calculations.

The discount rate is used in policy processes to underpin viability calculations. It is not surprising therefore, that resource exploitation for the current generation is deemed more viable than preserving the resources for future use. The neoclassical economic framework is based on the notion that present consumption yields a superior level of satisfaction to future consumption (e.g. (Harris, 2007)); future generations will benefit from the ongoing progress that economic growth provides. As Kohn (Kohn, 1999b) explains:

*Proponents of these approaches assume that the present generation is*

*entitled to consume more resources than future ones, because coming generations will be better off owing to their greater technological knowledge. Both schools assume that progress in science and technology will provide adequate opportunities for the substitution of resources. p87*

The discount rate is based on a notion, not fact. Bell and Morse (Bell and Morse, 2003) p12 give Solow's 1993 description of the discount rate as "... a concession to human weakness or as a technical assumption of convenience"(p12). This off hand remark from a pre-eminent economist underplays the significance of what is a powerful determinant in analysis of viability in the policy process.

The discount rate creates an ethical issue (Perrings et al., 1995) because all the calculations are biased towards the current generation, who also make the decisions. The interests of future generations cannot be known or quantified, and they are not represented in the marketplace. The interests of future generations are not protected because they are unable to bid in markets (Martinez-Alier and Schlupmann, 1987). As Young (Young, 1993) explains:

*Essentially discount rates reflect relative preferences for present and future consumption and anticipated marginal rates of return on capital. ...they also reflect an ethical judgment about intergenerational equity and the treatment of uncertainty. p22.*

#### *6.4.1.2 Discount rate as a sustainability policy tool*

Whoever decides the discount rate (the Commonwealth Statistician) that is used in a cost-benefit analysis holds the key to what is considered 'viable'. It means that by altering the discount rate, economists can construct a viability to suit the needs of their clients. Consequently, as economist Michael Young states, there is a "... never-ending debate over the most appropriate discount rate to use to compare costs and benefits in different time periods." (Young, 1993) p22.

From a sustainability perspective, changing the discount rate is a simple way in which the interests of future could be protected. A zero discount rate would mean that the future was at least as significant as the present; if it were made negative, the future would be regarded as something to be enhanced by present day economic activities. A future worth having may lead to an ethos of substantiated progress, building for the future, living within one's means. It is through the human construct of the discount rate that the future is being 'eaten' (Flannery, 1994).

The manipulation of the discount rate offers a potentially powerful tool for sustainability policy. It would require the reconceptualisation of the future among policy makers so that the needs of future generations became a policy objective: the future could be enhanced, not diminished by changing the discount rate. Protecting and enhancing the future is a crucial sustainability principle. Thus, formulating policy within a sustainability-informed framework will provide the rationale for respecting the interests of future generations that is not possible in the current economic system.

#### **6.4.2 Non-viability of sustainability**

The relationship between sustainability and neoclassical economics is described as incongruent when:

- sustainability is deemed to be not economically viable and therefore not practical
- economic viability is regarded as being not sustainable, because many resources utilised in production need to be free, and wastes generated in production are not the responsibility of the producer.

The clash between these two perspectives is generally resolved by accepting that economic viability has precedence over sustainability.

The precedence of economic viability is a cultural convention. It is problematic for two main reasons. On one hand, economic viability is derived from calculations made within the neoclassical paradigm that costs resources according to market price, which generally excludes environmental and non-renewable aspects.

On the other hand, sustainability is often perceived as an idealistic generalisation, an altruistic, idealistic, romantic goal that just doesn't "add up" in the current business climate. The dominant economic discourse perpetuates the notion that degradation is the price of progress, that economics and sustainability are inevitably conflictual; sustainability can only be achieved through economic policy if and when economic conditions allow. Sustainability is only affordable provided there is ongoing economic growth.

### **6.5 Epistemological anomalies<sup>54</sup>: cultural authority and scientific legitimacy**

Scientific understandings emerged in the 20<sup>th</sup> century that render untenable the 18<sup>th</sup> and 19<sup>th</sup> century metaphors, aphorisms and scientific understandings on which neoclassical economics is based.

Regardless of these new scientific understandings, neoclassical economics persists with simplistic approaches to complexity, using conjectural abstractions, metonyms<sup>55</sup>, metaphors and anthropomorphisms to create an illusion of coherence in their analysis and conclusions. The outcomes are economic policies that abrogate responsibility for decision making to the machinations of these mental constructs. Lowe (Lowe, 2009) suggests that the entire notion of economic planning has been abandoned in favour of a “naïve faith in the magic of the market” p34. The argument that the efficacy of the market system has been undermined by the very system that invented it is discussed below. It explains how sustainability-informed perspectives that differentiate between, for instance, speculation and creative entrepreneurship, can restore legitimacy and efficacy to market operations.

As it stands, there are no biophysical or socio-cultural limits in abstract neoclassical economic analysis, and no distinctions drawn between abstract, material or organic growth processes.

In contrast, from a sustainability perspective, there are distinctions and those differences need to be included in the way policy is framed. As Sachs (Sachs, 1999) argues:

*Organic development is entirely determined by the genetic character of the living organism and the interplay of environmental factors. It follows a rigid pattern: germination, growth, maturation, decay and decomposition. By contrast, socio-economic development is an open-ended historical process, which depends, at least in part, on human imagination, projects and decisions subject to the constraints of the natural environment and the burden of the living past (history). p29*

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<sup>54</sup> “...anomalies reveal that something is wrong with the structure our concepts give the world...” ANDERSEN, H., BARKER, P. & CHEN, X. (2006) *The Cognitive Structure of Scientific Revolutions*. Cambridge, Cambridge University Press. P172.

<sup>55</sup> Metonyms are abstractions, generalisations and aggregations that are interpreted as if they were a singular existential phenomenon (e.g. ‘the media’, the government, ‘climate change’).

The anomalies between holistic viability as conceptualised within a sustainability framework, and viability in the neoclassical economic paradigm reflect a polarity between the *cultural authority* that underpins the economic framework, and the *scientific legitimacy* which underpins our understanding of the socio-cultural and biophysical limits in which the economy operates. When policy makers opt for the neoclassical economic-framed viability, they are *defacto* deciding in favour of a culturally ordained paradigm constructed within a non-sustainable economic framework. On the other hand, a sustainability-framed viability approach framed within biophysical and socio-cultural limits is commensurable with contemporary science across many disciplines.

Through various processes, such as ‘procedural epistemic justification’ (Pollock, 2004), cognitive illusions (Piattelli-Palmarini, 1994), exnomination (Barthes, 1973), inattentional blindness<sup>56</sup> (Simons, 2007), and ‘cultural trance’ (Korten, 2009), the neoclassical economic episteme continues to frame the cultural narrative in which policy is created. Sustainability measures are justified only if it is deemed affordable according to neoclassical economic criteria. The paradox is that these criteria are inherently non-sustainable.

In addition, there is no mechanism within neoclassical economic theory for the fruits of progress to be re-allocated or redistributed to alleviate poverty and inequality, to allow workers to enjoy less working hours as a viable alternative to greater consumption requiring continued effort, or for the fruits of progress to be disseminated or redistributed in ways that allow less jobs. Despite promises of increased leisure from the silicon chip technology and the digital age, the problem of a ‘time poor’ populace remains. Progress has led to increased working hours, not less work.

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56 The phenomenon of ‘inattentional blindness’ SIMONS, D. J. (2007) Inattentional blindness. *Scholarpedia*. is ably demonstrated in the video clip where a bear moving through a crowd is not seen by most viewers because they have been asked to count the number of times a ball is thrown around by the ten or so other people in the clip. In the many times I have shown this clip, no one has ever seen the bear on the first time through, so attentive were they to the instruction of counting the throws of the ball. Inattentional blindness is one of the aspects I refer to when describing ‘cognitive deficiency’.

## 6.6 Implications: Lack of symbiosis creates an 'Implementation Gap'

The implementation gap is described as the gap between policy formulation (intentions) and practical outcomes. Pressman (Pressman and Wildavsky, 1973) states that the primary problem of sustainability policy is effective implementation<sup>57</sup>. The implementation gap arises because of an inability to deliver desired practical outcomes in a timely manner. Pressman (Pressman and Wildavsky, 1973) explains:

*An implementation gap exists between policy designs and the lack of action. In those cases where policies have been put into practice, they often look very different on the ground from the way those policy designs appeared when they were created. p13*

The policy implementation gap indicates a lack of symbiosis between sustainability and neoclassical economics. For example, 2010 had the highest reported emissions of greenhouse gases ever, and the rate of increase was increasing (Takver, 2011).

The existence of an implementation gap, and the new awareness of complexity and uncertainty described above, implies that conventional policy process do not have the capacity to deal with sustainability issues. As Dovers (Dovers, 2003b) states:

*...at least for some aspects of sustainability, there is a prima facie case that existing policy-oriented knowledge systems (including formal disciplines) and existing policy processes and institutions will lack explanatory power and operational purchase on sustainability, meaning that new understanding and capacities are needed. Again, those in the sustainability domain are more likely to agree that this prima facie case exists than those in traditional policy domains or disciplines. p3*

### 6.6.1 Legacy of simplistic approaches: the operational paradox

The 'Operational Paradox' is used to describe the situation in which contemporary policy approaches are unable to provide a 'highly complex, integrated and flexible' (Brown, 2000) approach and choose instead to opt for a simplistic conceptualisation of issues. The sustainability concept has the capacity to accommodate complexity, and is precisely what is needed, but a sustainability approach is deemed to be not

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<sup>57</sup> "The problem [of sustainability] has been, and remains, primarily one of implementation." PRESSMAN, J. L. & WILDAVSKY, A. B. (1973) *Implementation : how great expectations in Washington are dashed in Oakland*, Berkeley, University of California Press. P 13

operational because it doesn't accord with systemic capabilities and processes<sup>58</sup>. As a result, the goals of sustainability are dismissed in favour of what Svedin (Svedin, 1991) describes as a set of 'simple didactic mind models' (p16). Voss and Kemp (Voss and Kemp, 2006) see the rationalist approach to problem solving as being dependent on:

*... both the analysis of system dynamics to predict the effects of alternative options and the precise definition of goals and assessment of options to determine which is the best to be implemented through powerful interventions and sophisticated control systems. This kind of problem solving seeks to eliminate uncertainty, ambivalence and interference from uncontrolled influences. p5*

The paradox is that sustainability is dismissed as non-operational even though it accurately reflects and accommodates the complexity of the issues being addressed. It is a 'Catch-22' situation (Heller, 1961): A sustainability-framed approach is considered unworkable, ambiguous or unrealistic (Dovers, 2003b) even though it is precisely what is needed. The paradox reflects the cognitive limitations of policymakers and the epistemological constraints of the institutional structures in which they operate, rather than the conceptual deficiency of sustainability<sup>59</sup>.

A crucial consequence of adapting the policy approach to suit the capabilities of the policy framework is that it leaves out aspects of institutional processes that may be relevant to dealing with persistent and pervasive sustainability issues. As Grin et al. (Grin et al., 2011) explain:

*Persistent problems are complex because of their deep entrenchment in societal structures and their hardly reducible structural uncertainty; these problems are also difficult to manage, given the variety of actors with diverse interests involved, and hard to grasp in the sense that they are difficult to interpret and ill-structured. p107*

The operational paradox seems to arise because of a misconception that the sustainability concept is somehow responsible for *creating* complexity and

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58 "While the community of scholars and practitioners addressing sustainability issues have increasingly recognised the subjectivity and social embeddedness of our knowledge, these ideas are by no means well understood" SIKOR, T. & NORGAARD, R. B. (1999) Principles for Sustainability: Protection, Investment, Co-operation and Innovation. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar. P53.

59 c.f. the incapacity to comprehend a heliocentric view of the cosmos was the problem of those unable to grasp the new framework of understanding, rather than the hereticism or inadequacy of Copernicus' perceptions.



incertitude. Schön and Reid (Schön and Rein, 1994) argue that traditional approaches to policy analysis cannot explain intractable issues, nor facilitate their resolution. Meppem and Bourke (Meppem and Bourke, 1999) explain that amelioration of complex issues requires moving the approach and analysis to a different plane or level to the one in which the issues emerged:

*The idea that the process of resolving certain problems may be disabled because the resolution process is contaminated by the same 'level of thinking' endemic in the problem itself, is particularly relevant to the issue of environmental 'sustainability'. p390*

The integrity of policy is diminished when issues are framed to suit the simplistic frameworks that decision-makers (and controllers of the research funding) can handle. There may be outputs from such policy that fit within institutional criteria, but effective outcomes in terms of sustainability issues are less likely. Voss and Kemp (Voss and Kemp, 2006) put simplification in perspective:

*The more problem solving is disengaged from the full, messy, intermingled natural reality and oriented towards the worlds of specialists, the larger is the share of interdependencies and dimensions of embeddedness ignored in the development and implementation of supposed solutions. The more evasive such problem-solving is, the more effective it becomes with respect to particular instrumental purposes and the stronger the impacts of unintended consequences become. ...These unintended consequences cause new, often more severe problems that are more difficult to handle because they require setting aside specialised problem solving. p5*

The legacy of the operational paradox is that policy makers regard sustainability as an ideal that must yield to the 'real-world practicalities' of policymaking as it is conventionally practised. The operational paradox is a reflection of institutional structures and processes that do not have the capacity to accommodate complexity and incertitude. The operational paradox indicates that sustainability-informed institutional structures and processes are needed. How to achieve these outcomes is a question of governance, which is discussed below.

### **6.6.2 Legacies of simplistic methodologies: the reframing paradox**

The framing paradox occurs when the *issues* themselves are reconfigured in simplistic terms<sup>60</sup> to better suit the capacities of conventional policy approaches, or

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60 "... modifying symptoms will often be ultimately counterproductive, as deeper causal factors will 'fill up' any space created by them. 'Getting to the roots' is an inevitable part of any adequate strategy"

when only those issues that suit these capacities are addressed. The rationale is that simplified abstractions of complex issues make analysis more manageable and operational. It is a paradox because the complexity of the issues, or the context in which the issues manifest is the essence of what is creating the predicament. Simplistic framing of issues lead to misdiagnosis because the critical aspects of the issues needing to be analysed are tacitly assumed away *before* the analysis begins<sup>61</sup>.

The fact is that contemporary issues are unprecedented and it is reasonable to assume that they will not fit within existing policy frameworks. Issues are global and transcend political boundaries, time frames and geographical scales. Causal links may be nested in a hierarchy of relations that need to be considered, individually and in relation to each other. Causal linkages may span generations and the legacies of particular actions may emerge in unexpected domains at unexpected times. As Kane (Kane, 1999) explains:

*The biosphere itself is made of components which operate on very different scales of geographic scope and time. Add to that the complex nature of human societies with all their various layers, whether social, economic, ethical, technological or biological, and it is easy to understand why the general notion of sustainability has been difficult to operationalise. Each layer of human existence takes on its own dimensions of time and spatial impact, and decisions made with respect to one layer may have unpredictable consequences for others. Environmental problems which have recently come to fuel the urgency of the sustainability debate, such as global warming or tropical deforestation, are often traced back to economic decisions made by actors who evaluate their own actions based on decision criteria from only one or two of these layers. In order to reach a general state of sustainability, all of these layers must be included in our individual and collective decisions. p20*

When complex issues are reframed using simplistic concepts and causal relations, the result can conflict with sustainability perspectives and relationships. For example, Nordhaus and Tobin (Nordhaus and Tobin, 1973) argued that, from an economics point of view, scarcity of natural resources is a path to efficiency:

*If the past is any guide for the future, there seems to be little reason to worry about the exhaustion of resources .... The economist's initial presumption is*

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BRESSERS, H. T. A. (2004) Implementing sustainable development: how to know what works, where, when and how. IN LAFFERTY, W. M. (Ed.) *Governance for sustainable development : the challenge of adapting form to function*. Cheltenham, UK ; Northampton, Mass., Edward Elgar. P285.

<sup>61</sup> Simplistic is different to simple; simplifying is difficult and requires genius; simplicism is based on ignorance and or simplistic representations of complex issues. Populist solutions to complex issues are examples of simplistic responses.

*that the market will decide in what forms to transmit wealth by the requirement that all kinds of wealth bear a comparable rate of return.... In a properly functioning market economy, resources will be exploited at such a pace that their rate of relative price appreciation is competitive with rates of return on other kinds of capital. ... **Natural resources should grow in relative scarcity - otherwise they are an inefficient way for society to hold and transmit wealth compared to productive physical and human capital. Price appreciation protects resources from premature exploitation.** (Nordhaus and Tobin, 1973) p523-524 (My emphasis)*

This perspective overlooks the new understanding that, in complex systems, the past is not a guide for the future, and damage to ecosystem function or species extinction are irreversible and not mendable by changes in money prices. It is a facile approach to complex analysis. The internal consistency of neoclassical economics is elegant and precise, but it comes at a cost of relevance and realism. As Goodwin (Goodwin, 1991) states:

*In the current situation in economics, occurrences of mushy thinking take a different form, being disguised by the apparent crispness of mathematics, and rendered invisible to their perpetrators by their own frequent inability to interpret their results in real-world terms. The requirement that economic modelling should have a meaning in real-world terms is, at the moment, given scant attention in the dominant academic arm of the field. p147*

### **6.6.3 Legacy of simplistic analysis: malframing policy**

The causal relationships between the real and money worlds have changed <sup>62</sup>. Lee and LiPuma (Lee and LiPuma, 2002) explain how markets are now driving the economy, rather than the economy driving markets because of the development of sophisticated financial instruments and speculative capital (p209). Svedin (Svedin, 1991) explains that the causal relations are different:

*... depending on which perspective is used: an economic or an ecological one. The choice of systems boundaries is different in time and scale, the choice of variables is partially different and the emphasis on various elements differs. This holds true not the least with regard to the role of information in the various systems. p13*

This change in causal relationships for the initiation of economic activity has profound importance for sustainability policy because it has resulted in economic viability being determined by forces arising in the financial sector, which are derived

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62 "If productive labor once constituted the 'reality' of the economy, then, as one pundit put it, in the present moment, 'it's no longer the real economy driving the financial markets, but the financial markets driving the real economy' ... To explain the implications of this reversal, we need to consider what has happened to risk" POOVEY, M. (2001) For everything else, there's ... *Social Research*, 68. P413.

from abstract constructs and conditions, rather than being responsive to the limits and constraints of biophysical reality. Whereas in classical economic theory the capacity to invest depends on savings, contemporary investment practices depend on the capacity to obtain finance or to buy financial services. Lowe (Lowe, 2009) reminds us that the economy should be the means to environmental, social and cultural ends rather than as an end in itself (p82).

The causality of economic relations with the non-economic world has reversed, and the implications are not necessarily compatible with sustainability. An example of the impacts of reverse causality creating non-sustainable policy occurs when interest rates are increased to stabilise economic activity. The decision is made in the abstract domain of finance, but the impact occurs in the biophysical domain that is subject to ecological limits. If producers are driven to increase short-term production to meet interest payments by transgressing biophysical capacity to regenerate, land degradation will occur. Bringing marginal land into cultivation by clearing native bushland is a common example. Eventually, the abstract demands of the finance system push production beyond ecologically sound limits. This occurs when the 'needs' of 'the economy' frame the parameters of environmental management. This reversed polarity causes perverse causality that can lead to resource depletion, local extinctions, desertification or increased salinity of the land. It is likened to a modern usury in which abstract economic parameters override biophysical limits on which life depends. The legacies of this economic policy were explored by Burke (Burke, 1991) in relation to the socio-economic origins of the salinity problems of the Great Southern Region of Western Australia.

The situation is exacerbated because such policy approaches are regarded as 'normal'; the reversed causality has become embedded within the cultural episteme<sup>63</sup>.

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63 'Epistemology is a philosophical inquiry into the nature of knowledge, what justifies a belief, and what we mean when we say that a claim is true. ... As a self-conscious area of inquiry and as a coherent, developing conversation, it is usually dated from Rene Descartes' *Meditations*.... The twentieth century linguistic turn, which translated traditional philosophical problems into questions about language, had a significant impact on epistemology .... Alternative to the focus on language was a focus on psychology and the scientific study of cognition.... the naturalised approach to

## 6.7 Conclusion

The relationship between sustainability and neoclassical economics is dysfunctional and conflictual. There is conceptual and theoretical incommensurability between the two approaches that lead to incongruence and anomalies that are unable to be healed by reform processes. Neoclassical economics and sustainability have fundamental conflicts that mean that effective sustainability policy is not possible in the current situation.

Chapter 3 explained the implications of the new understandings of complexity. Chapter 4 discussed how the concept of sustainability had evolved and how the contestedness of the concept could be resolved. Chapter 5 discussed the neoclassical economic interpretation of sustainability and concluded that it was inadequate and inappropriate for sustainability policy. Chapter 6 has shown that the dysfunctionality between the two approaches is too deep to be resolved by reform processes. The need for policy makers to make a choice as to which conceptual framework they are to use to develop effective sustainability policy is emerging. Moving toward a conceptual framework for framing effective sustainability policy requires a profound paradigm shift (Dovers, 2003b) p1. The extent, significance and persistence of the imperatives for sustainability policy indicate that profound change is justified.

However, before addressing the nature of the change processes that may be required, the next chapter examines the epistemic intransigence of neoclassical economics. That is, how and why has it been immune to change despite the well-known, long standing and substantiated criticisms that have been levelled at the discipline.

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epistemology.' ALCOFF, L. (1998) *Epistemology : the big questions*, Malden, MA, Blackwell Publishers. P viii

## **Chapter 7: The tragedy of economism: the implications of epistemic dominance and intransigence**

### **7.1 Introduction**

In this chapter, the intransigence of neoclassical economics as a cultural episteme that underpins policy formulation and *acceptance* is examined. The concept of economism is invoked to help explain how neoclassical economics has infiltrated language and thought and become embedded and naturalised in the conventional cultural episteme. This is necessary so that the nature of changes required to bring sustainability and economics into symbiosis can be better understood. As well as the factors causing the intransigence, it looks at some of the implications of this intransigence.

### **7.2 Neoclassical economic episteme: economism**

The term economism describes the extent to which economic parameters are used to frame and validate social policy processes and outcomes (Teivainen, 2002). It is the belief that economic principles describe the way things 'really work', that economic issues frame the 'bottom-line' of policy viability. Economism describes the way that neoclassical economics has infiltrated the thought and language of contemporary policy processes. It is the dominant cultural episteme that frames contemporary policy approaches (Pusey, 1991). Bromley (Bromley, 2007) describes the impact of economics on public policy and political processes as:

*...a quest for public policy in which applied micro-economics is deployed as the only way to impose "rationality" on an otherwise incoherent and quite untrustworthy political process. ...This is not merely a clash of worldviews. It is a clash of contending truth claims about how to figure out what is to be done in the public sphere—it is confrontation between prescriptive consequentialism and reasoned public debate over how to get to the future. p677*

Wolfe (Wolff and Haubrich, 2006) describes economism as

*.. the charge that a theorist or policy maker has overestimated the significance of the economic realm. p750*

Economism is a worldview that Bourdieu (Bourdieu, 2005) describes as a type of

*...economic common sense, linked...to the social and cognitive structures of a*

*particular social order' that is formalised and rationalised to provide foundations for an (alleged) universal model. p10*

Economism is the belief that economics is based on laws that are natural, universal<sup>64</sup>, neutral<sup>65</sup> and fundamental<sup>66</sup> (Lehoux, 2006, Teivainen, 2002). White (White, 1996) explains that the tradition of natural law:

*... implies that there is a legal dimension beyond man-made law, a more eternal form of justice than that which is meted out by the state. p25*

As a result, economists tend to regard their discipline as the quintessential science that is independent of other disciplines. That is, there is not requirement that economics be commensurable with other sciences. However, although neoclassical economic analysis is constrained only by abstract parameters, in practice, economic activity cannot escaping basic laws of thermodynamics (Georgescu-Roegen et al., 1999). As Kohn (Kohn, 1999b) explains

*... the economic system is nested in a higher ranked system, 'nature'. The economic system extracts from nature low entropy matter-energy and converts it into high entropy matter-energy waste. Since the economic system exchanges matter and energy with this higher system, it is an open system... Pp89-90*

Similarly, the assumption of functional equivalence is incongruent with biodiversity. The assumption that there is perfect substitutability among factors of production ignores a whole suite of scientific perspectives on biological diversity. This conflict between the abstractionism required for analysis and the complexity of biophysical

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64 They ascribe to the belief that "... the economic approach provides a framework applicable to all human behaviour – to all types of decisions and to persons from all walks of life." BOURDIEU, P. (2005) *The social structures of the economy*, Cambridge, UK ; Malden, MA, Polity. P209, cited by BECKER, G. S. (1981) *A treatise on the family*, Cambridge, Mass., Harvard University Press. p ix

65 Teivainen defines universalisation as: "... presenting one's knowledge as constantly true and valid within a 'universe'. Neutralization means presenting one's knowledge as somehow above power struggles" TEIVAINEN, T. (2002) *Enter economism, exit politics : experts, economic policy and the damage to democracy*, London, Zed. P12. "With the doctrine of economic neutrality, I refer to a discourse according to which economic issues are somehow apolitical, beyond political power struggles..." TEIVAINEN, T. (2002) *Enter economism, exit politics : experts, economic policy and the damage to democracy*, London, Zed. P1. Bourdieu has a similar concept: 'Imperialising of the universal', meaning 'universalizing a society's own particularity by establishing it implicitly as the universal model' BOURDIEU, P. (2005) *The social structures of the economy*, Cambridge, UK ; Malden, MA, Polity. p225.

66 "...Hobbes pioneered modern Natural Law theory... by assuming not that human beings are sociable by nature, but that they are selfish, isolated individuals, and need protection from each other...Hobbes substituted a more restrictive sense of reason as calculation, the exercise of deductive logic, based on his beloved geometry and arithmetic. If an argument does not begin from generally agreed naming of things and proceed along the lines of 'Reckoning (that is, Adding and Subtracting)' towards 'certainty' which will be unanimously approved, then it cannot be called rational." WHITE, R. S. (1996) *Natural Law in English Renaissance literature*, New York, Cambridge University Press. Pp244-245

reality creates dissonance between sustainability and neoclassical economics (Figure 7.1).

Neoclassical economics is taught as a particular way of thinking about the world (Schabas, 2008). Neoclassical economists regard their discipline as a science, and not as a cultural narrative. It is suggested here that neoclassical economics is more accurately described as a ‘competing cultural narrative’ consisting of various analytical techniques and modes of writing.



Figure 7.1 Graphical interpretation of the relationship between sustainability and economism (Blight and Burke, 2009)

### 7.3 The tragedy of economism

Tragedy as a concept is open to interpretation. Two of these have particular relevance to this thesis. The first is “a sad event, a calamity” (Moore, 1999) p1419. This is used to refer to the way neoclassical economics is used as the predominant paradigm and episteme for framing sustainability policy when it is demonstrably inadequate and leads to iatrogenic outcomes. The second interpretation is of tragedy as a type of play in which “... the protagonist is often brought to disaster by an ... ‘error’ or ‘fatal flaw’... often in the form of hubris (excessive pride or presumption) which is punished by the gods or by fate...” (Moore, 1999) p1419. This



also relates to neoclassical economics because of its self-referentialism and analysis of complex reality in an untethered abstract framework.

The exclusivity of neoclassical economists is beguiling to scientists from other disciplines who wonder how they continue to get away with using their cognitively deficient approaches. It was when I began seeing economics as a mythology rather than a science or art that I began to understand the power and capacity to persevere that the paradigm has.

Neoclassical economics is generally described as an art or a science, but it can also be described as an ideology or religion<sup>67</sup>. As Tievainen (Teivainen, 2002) explains:

*Economy is a social and historical construction. One way to look at the construction of the economic sphere is to see it as an ideological concealment of the political reality behind it. p1*

If one moves outside of the self-referential confines of neoclassical economic theory, the neoclassical economic framework is exposed as being as much a mythology as a science or art (Campbell, 1973). Bourdieu (Bourdieu, 2005) describes economics as an ‘Imaginary Anthropology’:

*...a ‘deductivist epistemology’ (that equates rigour with mathematical formalization and derives ‘laws’ from a set of fundamental axioms that are claimed to be rigorous but ‘silent on the real functions of the economy’), an ‘intellectualist philosophy’ (that conceives of agents as pure consciousness without history), and ‘atomistic and discontinuist’ (‘that provides the basis for the model of perfect competition or the perfect market’). Pp220-221*

The belief system that underlies neoclassical economics is masked by thought processes that have turned conjectural abstractions – such as “the market”, “the stock market” or “consumer confidence” (Poovey, 2001) – into real “things” within the cultural episteme. They start as abstract constructions to facilitate analysis and become reified over time to be naturalised through general use to attain culturally authorisation as being real. Conjectural abstractions as an analytical tool were developed during the Scottish enlightenment. It has had a powerful impact on

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<sup>67</sup> BOETTKE, P. J., COYNE, C. J. & LEESON, P. T. High Priests and Lowly Philosophers: The Battle for the Soul of Economics. Department of Economics, George Mason University, Virginia, USA, HEYNE, P. (1993) Reaching for heaven on earth: The theological meaning of economics, By Robert H. Nelson. *Journal of Economic Literature*, XXXI, 231-232, HENDERSON, W. (1994) *Economics as literature*, London ; New York, Routledge.

Western culture and permeated conventional thought processes and language (Poovey, 2008). Combined with metaphors and aphorisms from the era, they form the ‘unquestioned truths’ (Bourdieu, 2005) which perpetuate the belief among neoclassical economists that their discipline is derived from natural law, not beliefs.

An alternative perspective is that neoclassical economics is a cultural narrative, as much as a science or an art (Thompson, 1996, Poovey, 2008, Henderson, 1994, Novak, 1976, Woodmansee and Osteen, 1999).

#### **7.4 Economic episteme and sustainability in context**

‘Doxa’ is a word of Greek origin that describes what is taken for granted in any particular society; doxa are beliefs or ‘unquestioned truths’ (Bourdieu, 2005). Epistemic knowledge has a different validity to doxastic knowledge. Pollock (Pollock, 2004) uses the phrase ‘procedural epistemic justification’ to describe the process by which beliefs that are formed in the right way are said to be justified. In other words, procedural epistemic justification is a validation process that leads to cultural naturalisation of knowledge – even if its origins are doxastic.

Neoclassical economics can be described as a doxastic paradigm (Huitt, 1999, Poovey, 1998) rather than a framework derived from natural law. The epistemological history of modern economics shows irrefutably that it is a belief-based framework<sup>68</sup> grounded in 18<sup>th</sup> century Scottish philosophy. A doxa forms the commonality of perceptions that underpins a cultural episteme.

A cultural episteme describes the framework of common understanding, or knowing, from which contemporary issues are addressed. Culture influences the

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68 “Much of epistemology is about how beliefs should be formed and maintained. It is about “rational doxastic dynamics”. Beliefs that are formed or maintained in the right way are said to be justified. This is the “procedural” notion of epistemic justification ... It is to be contrasted with the notions of epistemic justification that are constructed for the sake of analyzing “S knows that P”.... Procedural epistemic justification is closely connected to rationality. We can distinguish, at least loosely, between epistemic cognition, which is cognition about what to believe, and practical cognition, which is cognition about what to do. Epistemic rationality pertains to epistemic cognition, and practical rationality pertains to practical cognition. Rationality pertains to “things the cognizer does” — acts, and in the case of epistemic rationality, cognitive acts. In particular, epistemic rationality pertains to “believings”. Epistemic justification pertains instead to beliefs — the products of acts of believing. But there seems to be a tight connection. As a first approximation we might say that a belief is justified iff it is rational for the cognizer to believe it. Similarly, practical cognition issues in decisions, and we can say that a decision is justified iff it is the product of rational practical cognition.” POLLOCK, J. L. (2004) Irrationality and Cognition. *Inland Northwest Philosophy Conference on Knowledge and Skepticism*. Moscow, ID and Pullman, WA. p3

way we create and order knowledge; it provides rules and strategies for informing our actions and goals (Vanwynsberghe et al., 2007). A cultural episteme consists of thought patterns, language, ontology and methodological processes that are considered to be so self-evident as to be beyond question. An individual's cognitive framework is related to the cultural episteme in which it is encased<sup>69</sup>.

A cultural episteme tacitly frames knowledge in a way that is generally not evident to the user<sup>70</sup>. Not all decisions or actions are the result of conscious or rational ways of thinking<sup>71</sup>. The cognitive biases of this knowledge may be invisible or 'naturalised' so that they are regarded as normal or 'tacit' (Polanyi, 1967). Barthes coined the term 'exnomination' to describe knowledge that has become hidden because it is woven into the cultural fabric of everyday existence. Poovey (Poovey, 2008) (p 351-2) describes 'cultural naturalisation' as the process by which the socio-cultural milieu makes certain behavioural traits invisible to the members of that community. Bourdieu (Bourdieu, 2005) has the concept of 'habitus' to describe assimilation of ideas into cultural episteme and the phrase 'genesis amnesia' to describe the forgotten origins of culturally integrated ideas: the collective loss of memory concerning the origins of theoretical constructs or social perceptions' (Bourdieu, 2005). Korten (Korten, 2009) uses the phrase 'cultural trance'<sup>72</sup> to

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69 "... the objects of epistemic evaluation are cognitive processes, structures and mechanisms.... Social epistemology is concerned with the truth-getting impact of different patterns and arrangements of social intercourse." GOLDMAN, A. I. (1986) *Epistemology and cognition*, Cambridge, Mass., Harvard U.P. p5

70 "Our attitudes are not something that we consciously superimpose upon our everyday activities. On the contrary, taken-for-granted assumptions shape the way that we view the world, and implicitly guide our decision-making on environmental matters." LEMAN-STEFANOVIC, I. (2000) *Safeguarding our common future : rethinking sustainable development*, Albany, N.Y., State University of New York Press. p12

71 "A very important feature of the human cognitive architecture, and probably an essential feature of any cognitive architecture able to function efficiently in a complex and rapidly changing environment, is that beliefs and decisions need not be the product of explicit reasoning." POLLOCK, J. L. (2008) *Epistemology, Rationality, and Cognition*. IN STEUP, M. (Ed.) *A Companion to Epistemology*. 2nd Edition ed., Blackwells.

72 "The term *cultural trance* refers to a situation in which the members of the community fail to recognize that the stories that comprise the cultural story field of their community are theories and therefore are subject to continuous testing and change. The person who has developed the capacity to step back and recognize the cultural story field as a collection of shared stories subject to choice lives in a state of cultural awareness. The person who has not yet developed this capacity lives in a cultural trance, which limits their creative expression and leaves them subject to manipulation by advertisers and propagandists. One of the most critical steps in the individual journey to a mature consciousness is the awakening of a *cultural consciousness*, i.e., a consciousness or awareness of culture as a human construct subject to choice." KORTEN, D. (2009) *Cultural Trance*. NP

describe the means by which we 'normally' or automatically traverse the myriad of small tasks of everyday life.

Poovey (Poovey, 1998, Poovey, 2008) uses the concept of epistemological naturalisation to explain how an episteme becomes invisible in everyday life because the values and beliefs it represents are so taken-for-granted that they are too obvious to be worthy of explanation. Economism is culturally embedded and invisible. Naturalised economism means that the superiority of the economic perspective is taken for granted and the pervasive influence that the economic discourse has on policy is hard to explain – without sounding like an impractical romantic. Economists believe that the neoclassical economic interpretation of sustainability is *necessary and sufficient* to ameliorate complex issues.

Poovey (Poovey, 2008) points out that most modern economists

*... are indifferent to the history of their discipline and relatively uninterested in the foundational metaphors that govern economic writing. p10*

Without awareness of the historical origins of one's discipline, the capacity for context-specific biases and methodological shortcomings to be inherited or overlooked increases<sup>73</sup>. Contemporary economics is still pervaded with phlogiston-based metaphors (Schabas, 2003) – substitutability among diverse resources, for example.

Neoclassical economics can be described as a mythology, consisting of a set of culturally naturalised cognitive illusions (Piattelli-Palmarini, 1994) held together with epistemic irrationalities (Pollock, 2004, Pollock, 2008) that have successfully created an illusion of coherence among decision makers and the general public. That is, the art is to create the illusion that economic analysis somehow explains what is really going on 'behind the scenes'. However, the fact that it is a mythology

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<sup>73</sup> For example, there is an interesting description in Riskin RISKIN, J. (2002) *Science in the age of sensibility : the sentimental empiricists of the French enlightenment*, Chicago, University of Chicago Press. of the debate about 'being systematic' in 18th century, pre-revolutionary France. Designating someone as 'being systematic' was an insult, because systematisation implied the arrogant intent of dominating nature. It is interesting that although Adam Smith acknowledges an influence from French economic thought, the Scots aligned their epistemic framework with the existence of an abstract system underpinning economic reality. The French perspective was aligned with physiocracy, which seems to have been another casualty of the revolution.

or a set of illusions does not diminish its power or significance. Tievainen (Teivainen, 2002) warns that an 'imposed illusion' must not be taken lightly because to do so may be

*... somewhat misleading. If enough people act as if something called an economic sphere with an autonomous and natural logic exists, the sphere becomes in some sense real, even if socially constructed and historically specific. p1*

Poovey (Poovey, 1998) describes the economic narrative as consisting of theoretical writings as well as the writings of economic commentators who 'explain' to the general public what is happening in the secret machinations of the economy. The latter are journalists and financial writers who she refers to as 'belief makers' because they create and perpetuate the cultural narrative.

Neoclassical economics is a narrative that uses reified conjectural abstractions and abstract mathematics as its language (Arianrhod, 2005, Weintraub, 2002). The language of mathematics causes issues to be perceived as mathematical problems<sup>74</sup>. Framing issues as mathematical problems is thought to provide a more pure and objective conveyance of meaning than words (Arianrhod, 2005). However, as O'Connor (O'Connor, 2002) explain:

*While mathematical formalism can lend an aura of quantification - and hence of a superior(?) (sic) 'rationality' - to the evaluation procedure, these are situations where precise quantification is quite impossible. p40*

The predominance of economism is evidenced by the attempts to 'put a dollar value' on everything (commensurability), or, conversely, to ignore or demean their value because they can't be quantified (Boumans, 2001, Giridharadas, 2009).

Economism has become a dominant part of the global cultural episteme - especially since World War II. Increasingly, economic analysis has come to be regarded as *the* way of thinking that is needed to manage society. Economism is naturalised and deeply embedded. It means that the dominance of the economic narrative as the

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<sup>74</sup> This is particularly true in economics: The list of advances that the mathematization of economic theory helped or permitted is already long; and in one aspect it may appear lengthy. ... In the past two decades, economic theory has been carried away further by a seemingly irresistible current that can be explained only partly by the intellectual successes of its mathematization. Essential to an attempt at a fuller explanation are the values imprinted on an economist by his study of mathematics. DEBREU, G. (1991) The Mathematization of Economic Theory. *American Economic Review*, 81, 1-7. p5

basis for social organisation is rarely questioned because it falls below the horizon of the critical awareness in the cultural episteme (Poovey, 2008).

Without awareness of the epistemological history of the discipline (Poovey, 1998), and the contexts in which economic thought evolved (Klaver, 2003), the universality and neutrality of economic theory are not questioned (Teivainen, 2002). This perspective survives because the neoclassical economic paradigm is self-referential (Slife, 2004, Brantlinger, 1996).

Bromley (Bromley, 2007) explains that there is a defacto subsumption of political dimension by neoclassical economists; that is, economics purports to provide the scientific underpinnings for political decisions, what actually is decided is the role of politics:

*A central organising principle in economics is that there is something identifiable and separate called the economy. Coincident with this perception is the related idea that there is something else called politics. That these demarcations happen to mirror the disciplinary turf of modern universities is not unrelated to the bifurcated notion of the modern democratic nation–state.... But in the early years of the 20th century, when economics came to be defined more by its method (rational choice under cover of methodological individualism) than by its subject of inquiry (the economy), there emerged a felt need to differentiate the alleged “science” of economics from the mere “art” of governance and politics. Economics came to be about axiomatic models of rational choice, while government and politics remained concerned with interest groups, logrolling, power, and contested visions about the purposes of government and society. (Bromley, 2007) p676*

The underlying ‘truth’ of economism is that humans may think what they like, and vote how they will, but it will be economic reality that delivers the best outcomes. The problem is that there is more to policy and economics than neoclassical economists care to acknowledge.

## **7.5 Conclusion**

Examination of neoclassical economics as a cultural episteme helps explain how the discipline has become intransigent to change, despite well-known criticisms.

It shows that cognitive, conceptual and epistemological changes are needed to bring the economic approach to sustainability into line with contemporary understandings in other sciences. This is an important perspective because the

tendency is for non-economists to try to find ways to reconceptualise their findings in ways that will suit the economic framework. However, having established that the neoclassical economic framework is inadequate and inappropriate for dealing with complex contemporary issues, it is now established that the mode of change is cognitive, conceptual and epistemological. That is, the way to change neoclassical economics is to reframe the discipline within a sustainability-informed policy framework.

In broad terms, this means shifting the basis of policy understanding from the assumption of homo oeconomicus that underpins neoclassical economics, to homo sapiens which underpins all the other sciences and arts.

In the next chapter, some of the 'mental strategies' (Piattelli-Palmarini, 1994) and 'tools for thought' (Waddington, 1977) that can be used to steer the change process are discussed so that the specific changes proposed in subsequent chapters can be better understood.

Table 7.1 lists comparisons between three interpretations of selected aspects of economics: the economic, doxastic, and sustainability perspectives.

**Table 7.1: Comparison of economic, doxastic and sustainability perspectives**

Issue	Economic	Doxastic Interpretation	Sustainability Perspective
Legitimacy	Neutral, universal	Belief, Conjectural	Pluralistic Values
Competition	Brings efficiency	Competition is one motivator; cooperation is at least as significant	Motivations are complex and contextually dependent (culture, time and space)
Scarcity	The economic challenge is the allocation of scarce resources among multifarious ends	An anthropocentric perception of the bounties of the planet	Sequencing options and activities is more appropriate challenge for a systems approach.
Unintended consequences	The way self interest leads to optimal outcomes in the market via the workings of the invisible hand	Sustainability issues arise as unintended consequences of modernism;	Markets are significant but have limited applicability in resolving issues across the socio-cultural and biophysical hierarchies
General Equilibrium	Condition of stability occurring when planned savings equals planned investment; everyone is doing as they intend	An analytical tool based on mechanical metaphors from Newtonian physics	Not an appropriate concept of managing conditions within complex system dynamics
Consumer sovereignty	The consumer is in command of their economic actions; consumers have fixed tastes and preferences that are independent of socio-cultural influences.	Humans are motivated by considerations other than consuming; tastes and preferences are influenced by socio-cultural aspects	Citizenry is the basic socio-cultural role; consuming is one aspect of social living
Nature	Nature is a free good, external to economic considerations; can be represented in economic analysis by natural capital and valued according to the services provided by ecosystem function	Regarding nature as an externality is a legacy of 19th century perspectives on the limitless capacities of life systems on earth and frontier perspectives that more resources exist undiscovered elsewhere on the planet.	Economic aspects are a subset of social, cultural and environmental domains. Ecosystem health and ecological integrity are key aspects of sustainability
Pollution and environmental degradation	A result of market failure; ergo, extend the market, ascribe prices and institute user-pays systems	Symptoms of wasteful, inefficient exploitative management. A legacy of lack of respect.	Unintended consequences of modernism and economic expansionism



Productivity	Ratio of output to inputs	A limited interpretation of the results of human activity reflecting; a 19th century notion of 'work' and economic activity that is lacking as intangible goods and services increase in economic significance.	One of a suite of activities that may create wealth. Has little substantive meaning in a post-industrial society. Needs to be expanded conceptually to distinguish between productive activities and wealth derived by 'harvesting the synergy' through organizational activities.
Discount rate	The rate at which consumers/investors prefer present to future consumption/returns	A dominant belief in policy viability assessments that the future is less significant than the present; a culturally embedded notion that is not substantiable outside economic perspectives	Intergenerational equity is a key sustainability principle; a discount rate of zero is equitable; a negative discount rate will help delay exploitation of resources beyond their capacities to regenerate
Opportunity cost	Options foregone from a particular choice or action	Static, binary interpretation of options and possibilities.	Options may be assessed in a sequential format
Pareto Optimum	Social welfare improves only if no one is worse off; economic policy should not try to change social hierarchy	Social welfare is relational; all social change affects someone's perceptions of their own condition	Social welfare may improve with greater stability arising from more equal distribution and social justice
Market	Optimum mode of allocating resources	One mode of allocating resources	Market efficiency depends on income distribution and how money supply is created, by whom, under what authority, and how it is distributed
Poverty	Lack of employment or opportunity, and/or laziness and lack of skill	Social injustice with many aspects	Overcoming poverty is a key policy goal. Intra generational equity is a key sustainability principle: brings stability and wellbeing
Species' extinction	Possibly irrelevant as there may be substitutes, or cost of preservation too high	A legacy of human exploitation, anthropocentric arrogance	Ecological integrity is a key sustainability principle: all species have a role and right to exist

## Chapter 8: Framing the change processes needed for sustainability

### 8.1 Introduction

In this chapter, some of the 'mental strategies', methodologies and techniques affecting cognition, conceptualisation, ontology and epistemology that can be used to facilitate the change processes toward effective sustainability policy are discussed.

### 8.2 Background

The radical dissonance between the two conceptual frameworks of neoclassical economics and sustainability indicates that more than a policy reform process, regulation or community education is needed to move towards sustainability pathway. The challenge is to break the impasse caused by the intransigence of self-referential neoclassical economics and the dominance of economism in the policy discourse for sustainability. Durant (Durant et al., 2004) explains that sustainability issues cannot be resolved from within the same policy framework in which they emerged. Therefore, changing systemic parameters in favour of sustainability is needed. The persistence and pervasiveness of sustainability issues indicates that they are deeply rooted in ways-of-being that are embedded within, and reinforced by, cultural norms, institutional structures and processes. Rotmans (Rotmans, 2006) explains that

*The symptoms of unsustainability reflect a deeper-lying problem: these persistent problems are deeply rooted in our societal structures and institutions, and are closely interwoven with manifold societal processes, so that they cannot be solved in isolation. p6*

Schön and Reid (Schön and Rein, 1994) explain that cultural naturalisation reinforces the obvious, the conventional taken-for-granted perspectives:

*... in such a way as to make [the solution] seem graceful, compelling, even obvious.... This sense of obviousness of what is wrong and what needs fixing is the hallmark of policy frames and of the generative metaphors that underlie them....p28*

Hence, a degree of transcendence is required to countervail the epistemological and systemic attributes that are inhibiting remediation. Meppem and Bourke

(Meppem and Bourke, 1999) state that change needs to be transformational because:

*A dominant scientific/economic discourse has played a significant role in 'creating' the environmental problems we face, and, therefore relying on this same discourse and its ways of thinking to define and initiate sustainable practices may be itself a dubious and 'unsustainable' practice... the process of resolving certain problems may be disabled because the resolution process is contaminated by the same 'level of thinking' endemic in the problem itself... p390.*

Poovey (Poovey, 2004) provides a contextual perspective:

*...we must remember that the evidence we observe is rendered evidential by the theoretical paradigms that inform observation. The recursive structure that links evidence to theory is something we have learned to acknowledge, but too few critical theorists pay more than lip service to the problems that follow from this recognition. p429*

Harris (Harris, 2007) describes the breadth of the change process that is occurring in the broader scientific community as they come to terms with complexity, unintended consequences and sustainability:

*What is going on is a revision of what the sociologists call 'problematization' or 'methodologizing': how problems are defined and decided and by whom. Traditionally, problems would have been defined by scientists and academics with a particular disciplinary or methodological view of the problem... Over time problems are becoming larger, more complex and inclusive of many disciplines and hence 'ways of knowing'. New sources of information are being brought to the table. p246*

Andersen, Parker and Chen (Andersen et al., 2006) call for a scientific cognitive revolution. Tiles (Tiles, 1984) explains revolutionary changes in scientific thought as:

*... changes which involve the questioning and demotion of truths previously taken to be intuitively self-evident and beyond question, whether these are observational or highly abstract. Institutions must be changed; the rational subject must change the forms of his thought and thus the way in which he 'sees' the world as his intellectual view of the basic structure of reality changes. Pp181-2*

Piattelli-Palmarini (Piattelli-Palmarini, 1994) (P19) has the concept of 'mental strategies' is used here to describe the processes needed to recalibrate, reconceptualise and reframe the nexus between sustainability and neoclassical economics:

*The problem is not one of 'defining' or re-defining' the notion of rationality itself, but rather one of charting the mental routes that naturally lead to certain*

*intuitive beliefs, judgments, and preferences, and then assessing the relative merits and shortcomings of the ensuing decisions. (Piattelli-Palmarini, 1994) Pp1-3*

The conceptual dissonance and the intransigence of neoclassical economics mean that a profound degree of change is called for. Such changes are justified by the imperatives for effective sustainability policy. Wray (Wray, 2007b) explains scientific revolutions as:

*... those changes in science that (1) involve taxonomic changes, (2) are precipitated by disappointment with existing practices, and (3) cannot be resolved by appealing to shared standards. p61*

### **8.3 Changing awareness for conceptual and cognitive change**

#### **8.3.1 Transdisciplinarity**

A transdisciplinary approach is needed to integrate the diversity of specialised disciplines interacting with sustainability, and to accommodate the pluralistic perspectives that characterise complex issues (Loibl, 2006). In a transdisciplinary approach the contributions made by proponents of specialist disciplines are distinguished by degree of emphasis, attention and methodological refinement. Participants operate within a relational context, rather than a disciplinary hierarchy of a multidisciplinary approach. A *multi*-disciplinary approach may be described as experts from individual disciplines coming together at some point during the research project to exchange perspectives. However, expertise is not necessarily additive or commutative, and hence multidisciplinary is not a sufficient basis for resolution of sustainability issues.

Transdisciplinarity requires a willing tolerance to engage with, and appreciate, a spectrum of epistemological and ontological perspectives and cognitive capacities.

As Meppem and Bourke (Meppem and Bourke, 1999) state:

*Transdisciplinary notions aim to 'unmake' conventional ideas, conceptions and mindsets about sustainability. In practice this enables discussions of sustainability to be shaped by theories in fields other than the traditional scientific/economic discourse. p397*

An approach developed within a transdisciplinary framework can help overcome the limited but instrumentally rational approaches of monodisciplinary approaches.

Transdisciplinarity can facilitate synergies among agreeable specialists. A

transdisciplinary approach is an ambitious undertaking (Meppem and Bourke, 1999) but arguably more apt for dynamic, adaptive systems because it facilitates multi-level conclusions which are more appropriate for policy makers facing complex issues.

### 8.3.2 Reflexivity

Put simply, reflexivity is 'thinking about how one thinks'. To think reflexively is to critically analyse the nature of one's responses, and whether they may be limited by lack of understanding, information, or subject to cognitive, conceptual, ontological or methodological bias.

Approaching complex issues requires reflexivity in the methods and cognitive processes that are employed, including how decisions are made regarding what to measure, how to count it (Poovey, 1998), and how the accumulated data are to be analysed (Gallopín et al., 2001, Modvar and Gallopín, 2005). A reflexive approach means that the impact and limits of an analytical framework or paradigm are considered as part of the analysis being undertaken (Kemp and Loorbach, 2006, Voss et al., 2006, Weber, 2006); that is, how one's response may itself impact on the situation being addressed.

According to Voss and Kemp (Voss and Kemp, 2006), reflexivity has two related but different meanings:

*The first meaning of reflexivity refers to how modernity deals with its own implications and side effects, the mechanism by which modern societies grow in cycles of producing problems and solutions to these problems that produce new problems. The reality of modern society is thus a result of self-confrontation. This can be called first-order reflexivity. ...The second meaning of reflexive modernisation refers to the cognitive reconstruction of this cycle in which problem solving through instrumental rationality generates new problems. The impacts of technology, scientific knowledge production and the legitimacy and effectiveness of democracy are examples of problem areas where such reflection has brought up critical reassessments of rational problem-solving methods and led to the development of alternative methods and processes of problem handling that are more open, experimental and learning oriented. p6*

Reflexivity is increasingly recognised as a tool for sustainability policy makers.

Tàbara and Pahl-Wostl (Tàbara and Pahl-Wostl, 2007) explain that it facilitates

*... recognizing the diversity and complexity of the different types of mental models and cultural frames that influence problem definition and decision making... [providing] critical mutual reflection and the awareness and modification of assumptions and cultural frameworks that are taken for granted ...[and] reflect on assumptions about the dynamics and cause-and-effect relationships in the system to be managed... NP*

Reflexivity allows policy makers to become 'conscious of their ways of knowing' (Milbrath, 1989) and to 'understand the critical roles played by values and beliefs in the shaping of reality, and that science is not value free' (Milbrath, 1989).

Reflexivity helps the explicit recognition of the conditional nature of knowledge (Bradbury and Rayner, 2002). Thought patterns and approaches need to be addressed critically from time to time so that the validity of socio-cultural constructs<sup>75</sup> that create worldviews can be monitored. LeBaron (LeBaron, 2003) describes cultures as existing within worldviews that consist of values, beliefs and assumptions. Worldviews influence how we make meaning of our lives and how we relate to others and see ourselves.

Without reflexive thinking anomalies within and between disciplines may easily be overlooked because they are taken for granted out of habit. That is, they may have been epistemically justified and naturalised into the conventional episteme through various cognitive processes. For example, Pollock (Pollock, 2004) describes 'sketching effects' that arise when analysis is built on previous works, but the boundaries of those previous works are extended into different contexts, without fully acknowledging the limitations and assumptions of the original works.

A reflexive analyst considers the biases that are implicit, hidden, or usually unquestioned in the methodologies of particular disciplines, in order to critically assess the way issues are framed within disciplinary ontologies<sup>76</sup>. An approach that incorporates reflexivity can sharpen cognition and rationality. Cognitive rationality

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<sup>75</sup> 'For example, reality in qualitative research is understood to be a social construct. Hence much depends upon perspective, and this will be multiple as in [sustainable development]. An understanding (analytical) approach (as distinct from descriptive) is indispensable in such research, and case studies are central.' BELL, S. & MORSE, S. (2003) *Measuring sustainability : learning by doing*, London ; Sterling, VA, Earthscan Publications Ltd. P32

<sup>76</sup> "Without self-reflexive theory, such as that which is promoted through a transdisciplinary emphasis, the environmental discourse becomes fixated on promoting various instrumentally rational sustainability narratives which jockey for dominance of the discourse." MEPPEN, T. & BOURKE, S. (1999) Different ways of knowing: a communicative turn toward sustainability. *Ecological Economics*, 30, 389-404. P401

is reflexive about the environment in which it is acting (Pollock, 1993). Schön and Reid (Schön and Rein, 1994) developed the technique of critical-frame reflection as a way of teasing out inherent biases, discovering intellectual blockages, and opening pathways to options:

*... policy controversies are frame conflicts that may be pragmatically resolved by reframing, and that such frame reflection is central to design rationality--the kind of limited reason that is feasible and appropriate in policy making. (Schön and Rein, 1994) p166*

Reflexivity is vital for distinguishing between systemic non-sustainability and behavioural unsustainability as discussed above. As Dovers (Dovers, 2003a) points out, reflexivity provides scope for "...opening the possibility of change in the framework of beliefs, norms, and objectives" by which issues are analysed.

#### **8.4 Conceptual change**

##### **8.5 Reframing**

Concepts are used to frame issues and this framing shapes our thinking, priorities and actions (Norton, 2005). Meppem (Meppem, 2000) explains that:

*... how problems are conceptualised will largely define the solutions sought. ...The institutional structures of this discourse will reflect the prevailing power relationships and this will determine the acceptability of various arguments in the developmental debate... p48*

Schön and Reid (Schön and Rein, 1994) explain that a

*... frame encases the structures of belief, perception and appreciation which underlie policy positions. p27*

Andersen, Parker and Chen (Andersen et al., 2006) say that

*...frames define the structure of conceptual systems, not the content... p179*

Framing involves choosing the issue to be analysed, selecting pertinent variables and ascribing significance to them: what we choose to study is a reflection of an inherent 'mental map' (Svedin, 1991) derived from how we see the world. Facts are *created* and significance *ascribed* (Poovey, 1998) according to scientific and other methodologies, such as cultural traditions, myths and narratives. As Svedin (Svedin, 1991) explains:

*The set of potential issues you are ready to consider as "interesting" and/or "valid" provides a sort of window for what type of thinking is considered to be possible. Related to such an "interest-space" is normally some sort of mental map regarding relationships in general and a sense of where the key points are. This window directs attention and it leaves things outside the illuminated interest area in the form of less prioritized secondary items. p11*

Awareness of framing and conceptualisation processes helps one to recognise how certain types of approach can steer processes to particular policy outcomes – deliberately or inadvertently. At the same time, it means that reframing techniques (O'Connor, 2002) can be used to develop new approaches to issues and methodologies with which to analyse them and formulate policy (Schön and Rein, 1994). Weaver and Rotmans (Weaver and Rotmans, 2006) explain framing as an empowering part of the envisioning process in policy formulation. It is used to create:

*... a transformation of the unsustainability problem into a sustainability challenge. The sustainability vision is not meant to be a blueprint with a high predictive value, but rather an evolutionary vision with evolving long-term targets, and multiple pathways (scenarios, including policy options) onto these sustainability targets. The process of envisioning is therefore at least as important as the vision itself.... The potentially mobilizing capacity that the envisioning process contains for the stakeholders involved is of great importance. p14*

Other methods for framing approaches include options assesment (O'Brien, 2000, Beck, 2006, Loibl, 2006), grounded perspectivism<sup>77</sup> (Stirling, 2006), procedural rationality (Froger and Zyla, 1998), uncertainty management (Asselt, 2000, Asselt et al., 1995), vulnerability analysis (Kennedy et al., 2010) and reflexive governance (Voss and Bauknecht, 2006, Kemp and Loorbach, 2006). Each of these has a different emphasis and aim to provide practical approaches for dealing with complex issues.

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<sup>77</sup> "... It is 'grounded' because it includes a role for criteria of self-consistency, societal robustness and analytic or empirical quality. It is 'perspectivist' because it acknowledges that the latitude for divergent framings of such 'consistency', 'robustness' or 'quality' in knowledge extends beyond the monocentric approximations of fallibilism. In other words, under grounded perspectivism, it is acknowledged (with fallibilism) to be possible to discriminate between different representations of 'the science' on the basis of their plausibility or self consistency under any particular set of framing conditions." STIRLING, A. (2006) Precaution, foresight and sustainability: reflection and reflexivity in the governance of science and technology. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar. P248



### 8.5.1 Reframing economics for sustainability

A strategy suggested for transcending the impasse of economic dominance and intransigence is to reframe economics within a sustainability-informed framework. This would entail an approach in which the systemic and behavioural aspects of sustainability were differentiated, and the creation of a sustainability-informed ontology to frame sustainability and economic policy.

van de Kerkhof and Wieczorek (van de Kerkhof and Wieczorek, 2005) explain that sustainability policy needs

*...to focus on systems change, which cannot be brought about by technological innovations alone but which requires mutually reinforcing institutional and socio-cultural transformations... A system change may require not only new insights into the policy options that are available but also changes in the norms, values, goals, and operating procedures that govern the decision-making process and actions of organisations. p734*

From a change-process perspective, systemic parameters are frequently invisible to individuals on a daily basis. They form part of the cultural milieu that is taken for granted, too obvious to be questioned. Schön and Reid (Schön and Rein, 1994) developed the concept of the 'metacultural frame' to describe culturally shared systems of belief. Barthes (Barthes, 1973) used the term 'exnomination' to describe knowledge that is hidden from a person because of everyday use. Similarly, Poovey (Poovey, 2008) (Pp 351-2) describes 'cultural naturalisation' as the process by which epistemes becomes invisible to the members of that community when ideas are absorbed in the 'reality' of the socio-cultural milieu. In particular, she describes the processes by which economic matters are 'naturalised' to fall 'below the horizon of cultural visibility' so that individual economic transactions are not scrutinized but taken on faith. System failure impacts on sustainability policy through the institutional and cultural structures and processes in which policy is created and by which viability of behaviour is established and condoned. Meppem (Meppem, 2000) explains the interactions between institutions and individual behaviour:

*...[institutions are] merely regular behaviour patterns sustained by mutual expectations and should not be anthropomorphised into something other than this process for shared understanding and behaviour of participants. p57*

A conundrum arises because institutionalised systemic parameters and sustainability are not always symbiotic (Eltis, 1987); the parameters may be “characterised by structural instability” (Froger and Zyla, 1998) that inhibits movement toward sustainability. Without a symbiotic relationship between sustainability and the economic system, it is irrational for individuals to behave sustainably. For example, paying more for green electricity when coal-fired electricity is cheaper is, according to contemporary economic criteria, *irrational* behaviour. People may choose to do it (on ethical and moral grounds), but it is not economically *rational*.

Non-sustainable systemic parameters eventually lead to collapse and cultural and biophysical extinction (Kopp et al., 2005, Cooper and Vargas, 2004) if individuals’ behaviours are framed by systemic ‘rationality’. As Rotmans (Rotmans, 2006) explains:

*[The symptoms of unsustainability] are complex because they have multiple causalities, cover multiple fields, whereas ready-made solutions are absent. The persistence of these problems is the result of system failures that have crept into our societal systems. p6*

Hence, the imperative for change is that the *existing* nexus between economics and sustainability is asymbiotic; systemic parameters are encouraging unsustainable behaviour and impeding effective sustainability policy.

Effective sustainability policy requires adaptation of systemic parameters so that they are symbiotic with sustainability and facilitate sustainable behaviour. O’Connor (O’Connor, 2002) argued that a symbiotic approach to economics and sustainability implies acknowledging that the biosphere is not only, or primarily, a source of natural resources or raw materials for human exploitation. They are the life support systems that are necessary for life, as well as providing the context in which economic production can occur.

*...These are also habitats in the sense of being the places of life, invested with social and community significance, or meanings. So valuation for sustainability cannot be separated from the idea of actions whose effect is to sustain this or that form of life, way of life, in the cultural as well as ecological-economic sense. p33*

The challenge of overcoming systemic aspects that impede sustainability involves exposing the tacit aspects of the policy framework. The 'metacultural frame' can then be reconceptualised and reframed within sustainability parameters, principles, perspectives and processes.

#### **8.5.2 Conceptual differentiation of non-sustainability and unsustainability**

A conceptual distinction between 'non-sustainability' and 'unsustainability' is suggested for reframing the relationship between sustainability and economics. The distinction is used to differentiate systemic and behavioural aspects of sustainability-economic interactions, respectively.

Systemic parameters are used to frame issues and construct viability. Individuals manage or direct their behaviour according to systemic parameters, or cultural norms. The differentiation helps explain how a *non-sustainable* systemic framework can create a context in which it is rational and 'viable' for individuals to maintain *unsustainable* behaviour. Conversely, sustainable behaviour is constructed as being not *viable* when systemic parameters are non-sustainable. It follows that significant advances towards sustainability will not happen if the systemic parameters which frame individual behaviour remain non-sustainable. This is because sustainable behaviour will mean going against systemic parameters.

*Unsustainability* refers to behaviour, habits or culturally condoned activities that contribute to denigration of systemic properties, that is, not sustainable. For example, dumping toxic waste in the ocean, driving cars continually, or littering in the bush is unsustainable behaviour. Behavioural sustainability is ingrained in lifestyles, patterns of production and consumption (Dovers, 2003b) p2, ways-of-being and personal decision-making. Unsustainability issues are typically addressed through education for behavioural adaption and awareness-raising, or regulation supported by legislation. Behavioural change strategies may include encouraging less consumption, or promotion of more environmentally friendly or healthy behaviours such as not littering and minimising carbon emissions.

*Non-sustainability* refers to systemic attributes that are incompatible with sustainability. For example, the discounting of future values in favour of the present

is an aspect of neoclassical economics that conflicts with sustainability principles of intergenerational equity. The theoretical conclusion that scarce resources will lead to higher prices and their conservation conflicts with the sustainability principle of maintaining ecological integrity. Policies based on this perspective are without any understanding of ecosystem function or ecological dynamics. Systemic parameters, structures, and processes are non-sustainable, for example, if they facilitate or validate exploitation and waste of non-renewable resources. The extent to which a systemic framework is compatible with, or transgresses, the limits of biophysical and socio-cultural viability indicates whether or not that system framework is compossible with sustainability. Non-sustainability is a legacy of system malfunction. Rotmans (Rotmans, 2006) describes system failures as

*... profound flaws in our societal systems that cannot be corrected by the market or by external market interventions.... These system failures are profound barriers that prevent systems from functioning in an optimal manner. System failures operate at different levels and may differ by nature: institutional system failures (dominance of institutions that block innovation), economic system failures (insufficient market development or investment capital), social system failures (worn-in behaviour and habits that hamper change in behaviour), or ecological system failures (dominance of species or ecosystems that threaten biodiversity). p6*

Without distinguishing between non-sustainability and unsustainability, policy strategies may be ineffective because they are targeting an inappropriate aspect of a complex issue. There are a plethora of policy proposals aimed at sustainability, but there is a lack of *effective* sustainability policy (Cooper and Vargas, 2004).

### **8.6 Reconceptualisation as a change tool**

Humans are blessed with a dual nature: we are a biophysical animal subject to the dynamics of the organic world that is constrained by environmental and genetic factors, but we also have consciousness and with attributes, such as abstraction and imagination which can create 'worlds' without limits or constraints. As Sachs (Sachs, 1999) writes:

*Our species is the only one capable of inventing its future and of transforming its environment according to its will tempered, it is hoped, by a sense of realism and the principle of responsibility. p29*

Cognitive and conceptual change is an inherent characteristic and survival tool of *homo sapiens*. As *biophysical creatures*, humans impact on the environment and create an ecological footprint (Rees, 1992). However, humans also have a consciousness with which they are able to create constructs that are invisible and not necessarily self-evident or grounded in any biophysical reality. These mental tools for thought (Waddington, 1977) include abstractions, mythologies, cultural practices, ideologies, etc. They can be naturalised within cultures, and/or organised into epistemological disciplines that use particular methodologies. Harris (Harris, 2007) explains that:

*... Epistemology and science are changing also; what we know, how we know it and what we do with the knowledge we have already changed irreversibly.*  
p19

The point is that the relationship between concepts, cognition (the way-of thinking) and epistemology (the way-of knowing) are not fixed. Furthermore, humans have the capacity to change how they think and what they think. Indeed, the survival of the species has depended on it. Therefore, in times when unexplainable anomalies appear, the processes of reconceptualisation and cognitive change are useful tools for change (Waddington, 1977, Ruccio and Amariglio, 2003, Bateson, 1987, Crosby, 1997).

Despite the recent work done on framing techniques (Andersen et al., 2006, Barsalou, 1992, Dovers and Marsden, 2002, Kane, 1999, Kohn, 1999a, O'Connor et al., 1998, O'Connor, 2002, Pollock, 1993, Schön and Rein, 1994), the use of reconceptualisation as a way of bringing about change has not been taken up by mainstream policy analysts. According to Abraham and Mackie (Abraham and Mackie, 2006), most environmental economics remains in the neoclassical conceptual framework. The neoclassical economic approach to reframing is to devise ways in which non-market activities can be brought *into* their paradigm, that is, adapt the way the issues are framed so that they fit conventional forms of analysis. This process is evident when, for instance, scientists attempt to put price-based values on ecosystem services in order to demonstrate the significance of issues to policy makers within the economic paradigm. This is despite the fact

that the methodological and conceptual aspects used in these approaches contraindicate scientific integrity.

However, the possibility remains of changing the conceptual framework so that policy options can be devised within a broader context compatible with contemporary scientific understandings of biophysical and socio-cultural reality. Cognitive changes in science have underpinned some of the great advances in human history (Andersen et al., 2006). As Schacht (Schacht, 1990) writes:

*The social and cultural diversity of human existence past and present is also undeniable, and stands in striking contrast to the relative constancy and uniformity of our biological constitution. ... In particular, they ought not be taken to imply that the only terms in which the nature of human reality generally can be both meaningfully and validly articulated are those which pertain to our physiology or functional biological characteristics....we have become what we now are through a long history of social and cultural developments, which further cannot be assumed to be at an end; and that therefore humanity can be supposed to have no fixed and immutable nature ...*  
p168

#### **8.6.1 Ontological change**

Hoberman (Hoberman, 2008) describes ontology as a way of organising information by putting things into categories that are related to each other.

Bermego (Bermejo, 2007) describes ontology as "...a cognitive grouping of concepts, relations and attributes belonging to a particular field of our interest". The ontology used to frame analysis or create a model is chosen by the researcher. Therefore there is the possibility that changing the ontological framework can facilitate new ways of approaching issues and framing policy. There is no single or correct way to model or create ontology. Developing an ontological framework is an iterative process (Bermejo, 2007) that oscillates between defining concepts and structuring categories taxonomically (Welty and Guarino, 2001).

Ontological influence is powerful, but usually a tacit and naturalised part of a researcher's or policy maker's episteme. Ontology has cognitive, heuristic, adaptive, implementation and professional aspects (Bermejo, 2007). Our ontology frames our conceptualisation of the world (Welty and Guarino, 2001).

A relational ontology (Slife, 2004) is needed to accommodate the multidimensionality of sustainability and to transgress the diverse contexts in which issues arise<sup>78</sup>. Stocker (Stocker, 2008) explains relational ontology for sustainability to mean

*...that our focus is on the human experience of connection to places, communities and organisations. Under a more mechanistic or abstract ontology, humans see the world in terms of its components and their simple functional, instrumental interactions. p4*

A reconceptualised ontology can facilitate new ways of thinking, new ways of framing issues, questioning, and different ways of knowing. One can also cultivate different ways of looking at the same thing and/or re-interpreting its significance.

As Meppem and Bourke (Meppem and Bourke, 1999) explain:

*...‘truth claims’ are seen to be questionable, or at least negotiable, when they are seen alongside other contesting narratives which posit (with equal vigour) their own claims for ‘seeing clearly’ and for ‘knowing the truth’. p391*

Ontological change can provide a new context in which sustainability-informed policy can be framed. Welty and Guarino (Welty and Guarino, 2001) state that “...our ontological assumptions ... ultimately depend on our conceptualisation of the world” p54. Hence a move toward a sustainability-informed ontology would enable a closer affinity with contemporary understandings of complex issues to be incorporated into the accounting process. The move to a sustainability-informed ontology would require embracing the evolved concept of sustainability, and a movement away from the simplistic neoclassical economic interpretation of sustainability.

Bermejo (Bermejo, 2007) suggests that ontology should be precise, consistent, complete and concise, and contain:

- *Classes that represent concepts (either physical/specific or abstract/conceptual)*
- *Relations that represent association between concepts.*

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<sup>78</sup> Slife SLIFE, B. D. (2004) Taking Practice Seriously: Toward a Relational Ontology. *Journal of Theoretical and Philosophical Psychology*, 24, 157-178. describes ‘relational ontology’ as a perception of the relation between ‘particular lived experience’, as ‘a nexus of the experience’s relation to the whole....” P158

- *Attributes (also called properties, slots...) to describe the features of the concepts.*
- *Formal axioms to model sentences that are always true.*
- *Functions [that] are special case of relations (See Table 10.2)*
- *Instances that represent elements or individuals in an ontology. (Bermejo, 2007)*

Welty and Guarino (Welty and Guarino, 2001) have created a methodology for creating an ontology.

<b>Table 10.2 Bermejo's approach to developing an ontology (Bermejo, 2007)</b>
<p>An ontology development usually encompasses several tasks. Different methodologies order them differently:</p> <ol style="list-style-type: none"> <li>1. Enumerate important terms</li> <li>2. Define concept taxonomies</li> </ol> <p>The idea is to classify the concepts in a hierarchy (called among practitioners as taxonomy). Not all concepts will own a hierarchy, but as you were writing them down, some nouns seem to be related as types (subclasses) of other (superclasses).</p> <p>Traditionally, taxonomies/hierarchies are done following top-down (from general to specific), bottom-up (from specific to general) or combination processes. Choose one, but I find it more sensible to use a combination (up and down).</p> <p>There are different types of taxonomic relations, i.e., how the subclasses are related to the superclasses:</p> <ol style="list-style-type: none"> <li>3. Define relations</li> <li>4. Define attributes: Ontologists distinguish between class attributes (terms to describe concepts which take their values in the class they are defined, and they are not inherited in the hierarchy) and instance attributes (terms to describe concepts that take their values in the instance, and may be different for each instance).</li> <li>5. Define instances: An instance is an individual of a class, you can describe in detail relevant in- stances that may appear by giving them a name, concept to which they are related, attribute names and values.</li> <li>6. Define axioms, rules and functions: if you do not get here, ontologists consider your development a taxonomy. Some require axioms and rules to be described before describing in- stances. It is up to you. (Bermejo, 2007)</li> </ol>

This is an example of the sort of approach that could be taken to construct an ontology that is consistent with sustainability.



### 8.6.2 Concepts and cognition

A taxonomy and ontology are conceptually and cognitively intertwined. Andersen et al (Andersen et al., 2006) describe a taxonomy as a “specific [cognitive] structure in the conceptual field defined by a frame” p108. A taxonomy is used to organise and structure an ontology; creating a taxonomy is thus an inherently normative exercise (Welty and Guarino, 2001). Welty and Guarino (Welty and Guarino, 2001) explain that, as cognitive agents, we interact with and recognise significant entities in the world around us according to philosophical principles that form the basis for ontological analysis.

From a sustainability perspective, economic activities may be described as having aspects that impact in ecological, social, cultural and economic layers. These aspects and impacts can be described by their attributes and ascribed metaproperties according to a range of criteria relevant to sustainability. Clearly using a single criteria – such as price – to describe attributes and properties is to constrain the cognitive benefits of organising the information because monodimensional criteria leads to generalisations that mask important differentiations that may be relevant for policy.

Dynamic framing (Barsalou, 1992) was developed in cognitive psychology in the 1980s to describe the interplay between conceptual and cognitive changes. A dynamic framing approach to organising ontology is to make a shift from a list-based ordering of items to a relational-based, hierarchical ordering of items, based on a range of attributes and properties. Dynamic framing uses graded concepts (rather than exclusive definitions) to organise so that information can be structured into a nested hierarchy of categories. This means that common attributes and properties underpin the taxonomical structure.

The traditional notion of concepts is that they organise information according to ‘necessary and sufficient’ conditions. According to Andersen, Parker and Chen (Andersen et al., 2006) modern cognitive psychology underwent a revolution in the 1980s that made this approach outmoded.

Barsalou (Barsalou, 1992, Barsalou, 1993) and Andersen, Parker and Chen (Andersen et al., 2006) suggest that cognitive and conceptual change can be facilitated by conceptual re-organisation as described in the dynamic framing process. That is, cognitive change can be accommodated and facilitated when categories are organised as a set of graded concepts within a nested hierarchy of dynamic frames. Dynamic framing provides capacity to progressively differentiate prototypes within an integrated cogent whole<sup>79</sup>. As Andersen, Parker and Chen (Andersen et al., 2006) state:

*Cognitive studies have found that rather than treating all features as structurally equivalent we typically recognize certain hierarchical relations between features during categorization: that is, we know that some features are instances of others. ... subjects do not represent the category by a group of features with a flat structure. Instead, they represent it with more abstract attributes that take other features as values. Because they are more abstract, attributes function as generalizations in category learning. (Andersen et al., 2006) p47*

A graded concepts approach can be used to organise data for sustainability purposes because it allows a range of qualitative properties to be used to categorise information, and the dynamic aspect allows the taxonomy to adjust iteratively as new information or conceptualisations arise. The dynamic framing and nested hierarchical structure means that multidimensional data can be organised in ways that facilitate conceptual and cognitive change. The framing of attributes and metaproperties is an ongoing conceptual development process that evolves as new understandings and information emerge. Finding ways to reframe issues in ways that create new understandings of significance and relevance among data is a crucial part of the transition to sustainability (Milbrath, 1989).

The use of graded concepts – rather than definitive lists – allows pluralist perspectives to be assigned as attributes and metaproperties to activities. For example, computers may start their classification as accounting tools, but as they develop their capacity for use in publishing, print, music and communication can be accommodated by reclassification within new categories and conceptual frames.

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<sup>79</sup> Differentiation and integration are two key aspects of calculus of turning points in mathematics. They parallel the key processes of conceptual change.

### **8.6.3 Taxonomic change: From feature list to dynamic framing of graded concepts**

A taxonomy is a framework for ordering knowledge. Creating a taxonomical framework involves establishing various categories to structure knowledge and information according to criteria that is compatible with the ontological framework in which it is encased. Welty and Guarino (Welty and Guarino, 2001) state that a well-formed taxonomy has significant implications for the way issues are framed and accounted:

*Properly structured taxonomies help bring substantial order to elements of a model, are particularly useful in presenting limited views of a model for human interpretation, and play a critical role in reuse and integration tasks. Improperly structured taxonomies have the opposite effect, making models confusing and difficult to reuse or integrate. p53*

A taxonomy is a representational structure of different combinations of the properties or attributes of activities, however they may be conceptualised and categorised. This means that an activity can be categorised according to a cluster of attributes and metaproperties. A taxonomy can have many types of relations within and between categories, as well as among the activities that are included in those categories.

Andersen, Parker and Chen (Andersen et al., 2006) explain that taxonomic shifts are the crucial part of scientific revolutions because new understandings "... introduce violations of the hierarchical principles for the categories of the previous taxonomy." p108

This suggests that the process of creating a different taxonomy within a reconceptualised ontology can provide new ways of framing issues and facilitating conceptual and cognitive change. Methodologies for changing and creating taxonomies already exist. Therefore, creating a sustainability-informed taxonomy to structure economic activity within a sustainability-informed ontology may provide the mode of transition needed to transcend the neoclassical economic discourse, theory and episteme.

The challenge is to create epistemic transformation through active reframing issues, perspectives and processes to bring them into accord with sustainability. As

Meppem (Meppem, 2000) states:

*The concepts of sustainability, transdisciplinary and methodological pluralism invent and define each other, and are reflected within each other. These concepts cannot be understood independently of each other. Each concept is its own whole. p58*

The cognitive capacity of policy makers is an important consideration in deciding the type of change process required and possible. Andersen, Parker and Chen (Andersen et al., 2006) explain that cognitive capacity determines the ability to "... distinguish attributes from values...", and that the capacity "... to recognize feature correlations reflects the developmental level of human cognition." (Pp48-51) Without the cognitive capacity to differentiate and refine analysis, complex issues tend to be artificially simplified to fit within existing value frameworks.

In the next chapter, it is explained how categories within a sustainability-informed taxonomy can be populated with activities that are encoded with attributes of the activity itself and a suite of metaproperties that describe, monitor, indicate or assess the sustainability impacts of those activities. That is, the attributes describe the activities (e.g. manufacturing) while metaproperties describe the sustainability impacts of those activities (e.g. energy efficiency, life cycle analysis).

### **8.7 Learning and the change processes**

Creating a new taxonomy requires ongoing refinement and clarification of attributes and metaproperties. Hence there is need for an ongoing learning strategy to support the cognitive and conceptual change processes.

Learning is an integral part of the sustainability policy process. Milbrath (Milbrath, 1989) suggests that 'learning our way out' may be the only path for amelioration of complex contemporary issues.

Acknowledging the difference and unpredictability of sustainability issues requires ongoing learning in order to maintain the capacity for flexible management (Sendzimir et al., 2006). The dynamic and changing interface of socio-cultural and

biophysical systems requires different types of learning. Tàbara and Pahl-Wostl (Tàbara and Pahl-Wostl, 2007) explain that learning processes for sustainability need to be multifaceted:

*These processes include establishing the roles of leaders and networks, managing systems of knowledge, building trust and social capital, and making sense of information, as well as determining the extent to which boundary and bridging organisations are able to collaborate to incorporate their particular experiences and create collective action to build the capacity to adapt to change. (NP)*

Arentsen, Bressers and O'Toole (Arentsen et al., 2000) suggest that learning processes should be general and diverse and not aim to focus on specific issues too soon. The context for learning needs to incorporate the notion that, although the imperatives are urgent, change for the better *is possible*. The crucial act is to focus on learning what needs changing, and how to bring about those changes. Arentsen, Bressers and O'Toole (Arentsen et al., 2000) warn that the existing context and resources available for decisionmakers and learners may be deficient:

*... but also the "lessons" may ignore the institutional and cultural preconditions to successful adjustments, neglect the value of continued variation as a laboratory for future learning, ignore interactive effects, and lack consideration of differences between the subjects of the empirical experience and those to which these lessons are to be applied ... p601*

Complex issues require more than mere information dissemination. Traditional pedagogical approaches cannot easily respond to the cognitive, ontological and epistemological shifts required for participants to integrate these new understandings. Espinosa and Walker (Espinosa and Walker, 2011) explain that managing complex issues such as sustainability

*... is a highly subjective issue: it varies from observer to observer, and is directly connected to cognition; and observation of the world is always filtered by the observer's own mental modes. p29*

A facilitation approach offers a flexible and diverse suite of learning and expressive strategies for sustainability and social learning. Stirling (Stirling, 2006) describes the challenge as

*... finding practical ways to articulate complex forms of integrated 'transdisciplinary' appraisal with deeper and more inclusive forms of stakeholder engagement and citizen deliberation this time in strategy implementation. p258*

A hermeneutic approach describes meaning, interpretation and discourse are central foci of analysis; it differs from a rationalist approach in that it does not accept the notion of universal static objective knowledge. Brohman (Brohman, 1995) explains a hermeneutic approach as one that “... contends that empirical facts are not objectively given and universal but are socially constructed within particular historical settings”.

Lafferty (Lafferty, 2004b) describes the ‘ideational approach’ as one in which policy processes are carried out within a framework of particular ideas and various social interests that have differing relevance and significance. Although at any single point in time, one set of ideas may dominate the policy paradigm, this is regarded as the framework of ‘ideas and standards’ that frame the issues to be addressed, as well as the policy goals and instruments to be used in the process. Both the hermeneutic and ideational approaches are compatible with a degree of reflexivity in the policy approach.

In summary, three key *types* of learning have been distilled from the literature: sustainability learning, policy learning, and social learning (Table 9.1). Learning about the issues, and the constraints arising from complex contemporary issues and unintended consequences is called ‘sustainability learning’; learning about framing options to manage and deal with these issues and their implications is discussed below as ‘policy learning’; and learning about the processes needed to make (and accept) decisions within these new conditions of complexity and incertitude is discussed as ‘social learning’.

**Table 8.1: Learning and the hierarchy of sustainability issues**

<b>Sustainability learning</b>	<b>Social learning</b>	<b>Policy learning</b>
Issues as they manifest in the layers of sustainability	Acceptance of new levels of constraint	Understanding biophysical limits
Management of the issues	Involvement, respecting other views	Understanding complexity and incertitude
Government policy approaches to issues	Involvement	Governance, participation, engagement
Awareness of the issues	Micro to macro; local to global; interconnectedness	Pluralism, framing
Transition to sustainability issues	Individual responsibility; co-operative action	Implementation, viability analysis

### 8.7.1 Sustainability learning

A crucial challenge for sustainability policy makers is to appreciate the new understandings of complexity and uncertainty and the implications they bring to decision-making processes. As Steyaert and Ollivier (Steyaert and Ollivier, 2007) explain that:

*Facing complex and uncertain management situations, stakeholders have to learn about their natural and social environment and to change their understandings in order to increase their capacity to act in more sustainable ways.*

Sustainability learning describes learning about sustainability as a concept and achievable reality within the context of imperatives for action described above. It is learning "... to appreciate the complexity and interconnectivity of ecosystems and their implications for social action" (Milbrath, 1989), and to recognise the "mutual interdependencies and interactions in the existing networks of action" (Tàbara and Pahl-Wostl, 2007).

Sustainability learning requires policy makers to think 'holistically, systemically, and integratively' (Milbrath, 1989); it "entails a completely new way of thinking and a radical change in values" (Steyaert and Ollivier, 2007). It requires developing adaptive capacity, 'not merely learning about how to do the same things in a better way' (Steyaert and Ollivier, 2007). Tàbara and Pahl-Wostl (Tàbara and Pahl-Wostl, 2007) explain that the difference between sustainability learning and social learning is related to content and the criteria by which significance is ascribed. Sustainability learning is focused on

*... increasing the capacity of agents to manage, in an integrative and organic way, the total social–ecological system of which they form a part. (Tàbara and Pahl-Wostl, 2007) NP*

### 8.7.2 Policy learning

Policy learning describes the process of learning how to 'press ahead' when, despite uncertainty, further delay is not an option. Bressers and Rosenbaum (Bressers and Rosenbaum, 2000) explain that:

*Dealing with uncertainty involves not only finding solutions through the acquisition of knowledge, policy innovation, institutional redesign or other strategies. It requires a determination of "press ahead" with policymaking*

*despite uncertainty, to avoid the temptation to inertia, or an unfettered retreat into "further study," when uncertainties inevitably arise in environmental policymaking. p525*

Multidimensional complex issues require a dynamic policy approach in which processes are open and decisions unfold according to errors made, qualitative changes, unfolding awareness and adaptation (Rammel et al., 2004). The emphasis on pathways rather than specific outcomes requires expert opinion to be considered as part of a broader range of narratives and perspectives reflecting pluralist epistemological frameworks. Specialist perspectives have the potential to suffer significant 'blind spots' or 'inattentional blindness' when addressing the inherent unpredictability of complex systems<sup>80</sup>.

The conundrum of a process-oriented approach to policy is that if action is delayed while waiting for consensus in the face of high levels of uncertainty, issues may become irreversible with irreparable damage. Alternatively, if they act before sufficient information or consensus about the appropriate next step is available, it may be revealed later that the problem was not as serious as postulated or that the policies adopted were inappropriate. (Brown, 2000)

Accordingly, there is a need for policy learning to focus on decision-making processes in conditions of uncertainty and incomplete information. The tendency here is to apply risk assessment based on Bayesian probability methods, but, as described above, such approaches create an illusion of certainty rather than a capacity to manage uncertainty (Froger and Zyla, 1998, Funtowicz and Ravetz, 1991).

Bressers (Bressers, 2004) describes Contextual Interaction Theory (CIT) as a framework for policy learning (p287). It recognises that understanding the policy

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80 "Science, whether natural or social, is conducted by humans and is thus itself subject to human choice. Thus the treatment of values involves more than addressing the values of affected populations; it involves also consideration of the researcher's or proponent's values. .... the agencies and' experts who advised them chose what to study and what to ignore, what methods to use in their analysis and what criteria to apply in determining the validity of the data they gathered. In making these choices, we therefore inevitably make value judgments. ...Yet excluding human agency from applied social science research is itself a powerful and constraining assertion of the researcher's own choice upon society." BRADBURY, J. & RAYNER, S. (2002) Reconciling the irreconcilable. IN ABAZA, H. & BARANZINI, A. (Eds.) *Implementing sustainable development : integrated assessment and participatory decision-making processes*. Cheltenham, UK ; Northampton, MA, E. Elgar, for and on behalf of UNEP. pp 26-27



implementation process “... is not only about *achieving* implementation, but also about attempts to *prevent* implementation or to *change the character* of what is implemented” p287 (my emphases). In this approach policy is contextualised according to “the characteristics of the actors involved, particularly their motivation, information, and power” (Bressers, 2004) p290. It acknowledges that governments, stakeholders, target groups and other agents usually have a history of interaction and influence before the policy process is activated. In this approach, new policy is regarded as part of a continuum, that adds a ‘new contextual element’ to what is already happening to a greater or lesser extent.

The contexts in which policy processes occur are critical to the overall policy process. The policy arena describes the contextual environment in which policy making occurs. Policy arenas have physical, temporal and processual aspects.

Creating scenarios is another tool for policy learning (Sondeijker et al., 2006). Asselt (Asselt, 2000) describes scenarios as being hypothetical descriptions of future pathways; processes that describe sequences over time; descriptions of causal relations between actions and consequences; which start at the present time and end with a fixed time horizon (Asselt, 2000).

### **8.7.3 Social learning**

The cultural naturalisation of sustainable ways of being is a major goal of sustainability policy, much as the normalisation of personal hygiene was a goal of public health policy. Voss and Kemp (Voss and Kemp, 2006) explain that trade-offs:

*... feed social disputes about what is sustainable and what is not. These disputes, however, can only partially be resolved scientifically, but also need to be addressed with social discourse or political decision. p15*

Social learning is the process by which policies can be socially legitimised and made acceptable – in much the same way as public health reform required social learning and adaptation of behaviour. Learning about how the new constraints on lifestyle possibilities can be managed constructively (as were the constraints that public health policy required) is crucial to the way policy changes can be implemented.

Developing a credible consensus among valid pluralistic perspectives of complex issues is a particular challenge. Meppem (Meppem and Bourke, 1999) explains how a 'preferred' narrative can be supported and extended among participants in a policy process:

*Just as scientific/economic 'truth claims' are constructed upon a 'knowledge' which is taken by its practitioners to be the appropriate basis for decision making, all other interest groups participating in the discourse also provide data and methods which tend to confirm their own 'preferred' interpretation or narrative. ... the rhetoric of various stories, perspectives or narratives are viewed as ideological 'forms of persuasion'. Analytical tools support and extend the rhetoric of a particular narrative, so that, surveys, models and forecasts can be thought of as rhetorical tropes... p391*

Sustainability can provide the over-arching concept by which the commonality and mutuality of interests by various stakeholders can be discussed and drawn out. A sustainability narrative is needed to develop ways and means of interpreting and expressing sustainability. Social learning focuses on the dynamic, multidimensional, pluralist and unpredictable aspects of sustainability issues. It is "an essential element of policy development and implementation" (Pahl-Wostl et al., 2007) because it generates and responds to the cultural narrative in which sustainability policy exists. As Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) explain:

*Central to post-normal science is the need to assure the quality of the decision making process through managing the uncertainty and accommodating different perspectives and ways of knowing by engaging an extended peer group ... the existence of a multiplicity of legitimate perspectives and the need to integrate/incorporate them in the decision making process is of particular importance ... p248*

van de Kerkhof and Wieczorek (van de Kerkhof and Wieczorek, 2005) explains that engagement and social learning are intertwined:

*The concept of involvement starts from the observation that actors will be unlikely to change their understanding of a complex problem situation if they are merely provided with new ('factual') information. Understanding a problem requires not only factual and empirical knowledge but also insight into the normative aspects of the problem, which may partly be subconscious. Ignorance does not primarily follow from a lack of information on the 'facts' but from a lack of insight into the (conflicting) normative assumptions underlying the different viewpoints. p739*

Social learning requires discussions about the boundaries that are used to define who is to be involved in the process, the ways in which issues are debated and

negotiated, and the rules and leadership roles developed to facilitate, coordinate and steer the process (Tàbara and Pahl-Wostl, 2007). Bressers (Bressers, 2004) describes the generation of sustainability policy as a process of social interaction:

*Doing so shifts attention from policy as a sort of production process, with semi-finished products and an ultimate end product, to a vision in which the actors participating in the process are the central concern. p289*

Social learning refers to coming to terms with "... other viewpoints of reality' rather than merely 'transfer of knowledge'...social learning is aimed at the process of reframing, which ultimately leads to a change in perspective" (Grin et al., 2011) p5.

Social learning includes:

- The type of decisions to be made -- to deal with complexity
- The way decisions are made – to deal with pluralistic perceptions
- The legitimising of decisions – to facilitate effective implementation
- The way learning is facilitated – to accommodate different learning styles
- The institutional frameworks and governance processes necessary to facilitate social learning.

Milbrath (Milbrath, 1989) argues that a key challenge is to develop capacities to work together, and to learn how to engage constructively with other peoples' values and to respond to scientific evidence. This involves learning about empathy, compassion, respect for other cultures and future generations, and the need to ensure the integrity of the biosphere is maintained. Meppem (Meppem, 2000) suggests that the 'diversity of discourses' is not just about content, but also about the ways in which citizens 'are able to represent their divergent claims for attention in development decision-making that impacts on, and structures, their lived spaces'. Social learning needs to cultivate an understanding that the 'long term flourishing of more healthy and meaningful forms of life...[may require] ... forms of regulatory restraint ... to meet the sustainability challenge' (Brady, 2005) p403.

Tàbara and Pahl-Wostl (Tàbara and Pahl-Wostl, 2007) explain that social learning needs to be built by “sharing different points of view and types of knowledge” within an “emerging community of practice ...induced by promoting public participation”.

Social learning is closely linked with public participation<sup>81</sup>. Sustainability policy needs to work within an *interpretive framework*. Effective public participation is needed to provide legitimacy for policy decisions, but also to help create the robust narrative and understandings needed for dealing with the challenges of complexity and uncertainties (Tàbara and Pahl-Wostl, 2007).

Social learning provides the opportunity to frame issues within a broader, multidimensional context that de-emphasises the need for compromise and emphasises the possibilities of synergy across pluralist value systems. Stocker and Burke (Stocker and Burke, 2009) describe community workshops that use free digital mapping (GoogleEarth) technology in which participants map their special places, according to social, economic, ecological and cultural criteria. Discussion in the workshops is framed within a sustainability context beginning with the notion of sense of place. Participants find and map places of significance in each of the four layers of sustainability (cultural, social, ecological and economic). These are done in four separate stages, and then combined to find the sustainability hotspots where there is significance in all four layers. The interactions between layers are then discussed and compared. Participants are encouraged to look for synergistic relations between these aspects to frame conversation with others, and avoid the conventional notions of trade-offs. The next stage asks participants to list the issues and concerns for each of the hotspots, and then to suggest remedial actions for policymakers to consider. The need for more ongoing learning and research emerge as strong and positive outcomes.

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81 “Broadened involvement in decision-making with a view of expanding support if not consensus can be seen as an institutional response to continuing normative uncertainty as well: a way of requiring dialogue as a standard part of policy discussion.” ARENTSEN, M. J., BRESSERS, H. T. A. & O'TOOLE, L. J. (2000) Institutional and policy responses to uncertainty in environmental policy: A comparison of Dutch and U.S. styles. *Policy Studies Journal*, 28. P601

The new technologies of the digital era provide unprecedented opportunities for public engagement, information access and dissemination, analysis, as well as increased options for incorporating different types of information in the policy processes. Readily available processing power provides opportunities for new and different algorithms to be created for analysis of complex issues (Embrechts, 1994, Bertuglia and Vaio, 2005, Kiel and Elliott, 1996, Davis, 1994). They provide great scope for new learning strategies that enhance uptake and encourage constructive engagement and participation. For example, Google Earth mapping software offers a new dimension for map-based discussions and presentations in a community context (Stocker and Burke, 2006, Stocker et al., 2012).

Pahl-Wostl (Pahl-Wostl et al., 2007) suggests that social learning needs to be facilitated by institutional frameworks that provide stability without being rigid or inflexible, and which are disposed toward continuous learning and adaptation:

*In these processes, stakeholders at different scales are connected in flexible networks that allow them to develop the capacity and trust they need to collaborate in a wide range of formal and informal relationships ranging from formal legal structures and contracts to informal, voluntary agreements. (Pahl-Wostl et al., 2007) NP*

### **8.8 Language and the interpretations of sustainability**

Meppem and Bourke (Meppem and Bourke, 1999) suggest that the role of language is critical because it frames the meanings and possibilities in which analytical approaches are bounded. Sikor and Norgaard (Sikor and Norgaard, 1999) explain:

*Within the broad search for sustainability and the means for implementing it ... [there is the emerging] realisation that what we understand of reality is intimately tied to the history of how we have used words in the past and hence our understandings in the past. p51*

Espinosa and Walker (Espinosa and Walker, 2011) explain that the

*...most basic mechanism for managing complexity is by making distinctions in language. Pp29-30.*

The homogenising of complexity into various forms of capital has the reverse effect: it over-rides the need for making distinctions. The language used by neoclassical economists to carry out the arrogation process helps mask the extent to which complexity has been over-ridden conceptually.

I invented the term ‘capitalisticism’ to describe the way the arrogation process was facilitated by the subtle creation of a worldview that reality is best perceived as various forms of capital. In this view, the complexities of biophysical and socio-cultural dynamics are distilled into amorphous units of ‘capital’ – natural, social, human, intellectual, etc – “without actually working through the argument” (Pollock, 2004) p9. These conceptualisations have been absorbed into mainstream economics – and the cultural narrative – in a relatively short period of time. According to Akerman (Akerman, 2003), the concept of natural capital as a representation of environmental values was developed by Pearce et al. (Pearce and Turner, 1990) in the late 1980s. Although Pearce was well-meaning (Turner)<sup>82</sup>, this conceptualisation of nature has been counter productive because it has steered policy analysis into a framework in which environment is calibrated as an amorphous concept of capital, without regard to the essential complex, dynamic attributes of living systems, such as irreversibility and non-substitutability. Natural capital over-rides any distinction between species and is not commensurable with any other sciences. This concept of capital is reminiscent of 18<sup>th</sup> century phlogistonism that held that the combustible world was impregnated by phlogiston that was released by fire (Conant, 1967).

The legacy of capitalisticism is the creation of an economic meta-language that frames policy and has penetrated language and thought. It is a technique that creates a cognitive illusion (Piattelli-Palmarini, 1994) and perpetuates what I call an economic illusion of coherence that mystifies non-economists and deflects deeper analysis of sustainability issues. It is a case where “value-based assumptions have disappeared” so that they seem “natural” (Bradbury and Rayner, 2002) Pp26; or to use Pollock’s (Pollock, 2004) phraseology, a case where it is presumed that:

*... certain things are inferable on the basis of other things without actually working through the argument. p9*

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<sup>82</sup> “The key for Pearce was to place economics at the core of ‘practical environmentalism’ in order to make a difference in the real world.” TURNER, K. The Blueprint Legacy – a review of Professor David Pearce’s contribution to environmental economics policy. *CSEERGE Working Paper*, PA. P1.

Productivity is another word commonly used in economics that has an outmoded meaning. Originally related to output from humans working with or without machines, it remains part of the jargon even though it does not adequately represent the relationship between effort and income generated in a post-industrial society. There are frequent calls for efforts to increase productivity to avoid economic calamity, but it is not a valid concept for the service sector, for instance, where quality is a crucial determinant of the worth of activity. It is particularly interesting to hear highly paid executives calling for productivity increases when their own salaries are derived from balance sheets rather than effort. I think productivity should be put into a spectrum of activities, with productive output at one end, harvesting synergy in the middle and extraction at the other end. Harvesting synergy is a concept I devised to explain the way corporate executives earn an income by their organisational efforts. This concept requires further development and research.

### **8.9 Conclusion**

The need for profound changes to create a symbiosis between sustainability and neoclassical economics was established, but the types of changes needed required investigation because of the intransigence and pervasiveness of the neoclassical economic episteme. Two aspects of the change process emerged: one to overcome the dominance of neoclassical economics over sustainability, and one to overcome the intransigence of the neoclassical economic episteme. The tragedy of economism explained the implications of ignoring the imperatives for change.

In this chapter the idea of framing a change process using cognitive, conceptual, ontological and epistemological aspects to reframe, reconceptualise and restructure ways-of-thinking and ways-of-knowing about sustainability and economics was examined. Various aspects of existing techniques and approaches were discussed. Transdisciplinarity is needed to provide the multidimensional perspective on complex issues. Reflexive thinking is necessary to countervail the tendency to lose critical analysis by tacit adherence to the embedded cultural narrative, regardless of its sustainability credentials. Reframing allows issues to be looked at differently, across a range of perspectives and value systems. Reconceptualisation allows

different ways of thinking to be developed by ascribing sustainability-informed significance to a range of variables previously excluded from analysis. Concepts are linked with cognition, and derived from and contribute to ontology. Taxonomy allows the structuring of knowledge in order to enhance cognitive development and understanding. The different types of learning that are needed to accommodate complex sustainability issues were identified and discussed. These are necessary to create and adapt the cultural narrative so that it is symbiotic with and supportive of sustainability goals and ways of being.

In the next chapter these conceptual and cognitive change strategies are put into a framework developed to provide a sustainability-informed context for analysis of viability that will enable sustainability policy to transcend the constraints of neoclassical economic analysis.





## Chapter 9: Reframing economics within a sustainability framework: viability analysis

### 9.1 Introduction

The anomalies, incongruence and incommensurability that characterise the nexus between sustainability and neoclassical economics reflect a dissonance between the systemic construct of economic viability, and the sustainability behaviour that it promulgates. At the time of writing, the need for an alternative approach to economic assessment of viability is expressed, but there is no non-neoclassical economic framework for doing so.

Basically, the problem is that the parameters by which the viability of sustainability policy is evaluated are set against sustainability (Lee, 1993). As Clark (Clark, 1991a) writes:

*...no economic forces [are] acting in favour of sustainable development in the biosphere. Individually rational human incentives mitigate against sustainability.... Economic growth is assessed by the rate of growth of the GNP, with no attempt to account for the stripping of resource or environmental assets. Pp322-325*

Multidimensional consideration of the viability of sustainability policy is thwarted because the multifaceted aspects of sustainability issues are analysed with monodimensional economic criteria in a framework that is demonstrably inadequate and inappropriate. The dominance of economic aspects over cultural, social and ecological dimensions means that non-sustainable parameters are framing the viability of sustainability policy. Economic expansion is the current policy prescription for economic stability. This iatrogenic outcome arises because the neoclassical economic focuses their analysis on equilibrium and optimality within static abstract systems<sup>83</sup>.

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<sup>83</sup> "The nature of the choices inherent in the setting of ecological, social and economic sustainability goals cannot be expressed satisfactorily in such terms as 'optimal choice', nor can the pursuit of sustainability goals be guided by market-based valuations. The reasons for this are simple. Optimal choice requires, at some level or other, the application of a single principle for ordering, judging and ranking what is right and 'best'. But 'sustainability' in its general social-economic-ecological acceptance signals a requirement to accommodate a multiplicity of different ordering principles, and its realization will depend on cherishing the richness of living with and living in nature with its great variety of life forms." O'CONNOR, M. (2002) Reframing environmental evaluation: reasoning about resource use and

The sustainability perspective is that social, cultural, environmental and economic issues are intertwined<sup>84</sup> and cannot be resolved independently of each other (Dovers and Handmer, 1997). As Kane (Kane, 1999) explains:

*Environmental problems which have recently come to fuel the urgency of the sustainability debate, such as global warming or tropical deforestation, are often traced back to economic decisions made by actors who evaluate their own actions based on decision criteria from only one or two of these layers. In order to reach a general state of sustainability, all of these layers must be included in our individual and collective decisions. p20*

An analytical framework that *transcends* the neoclassical economic discourse is needed so that the viability of sustainability policy options can be analysed and assessed in a multidimensional, dynamic framework that adequately represents the context in which complex issues actually arise. More than economic reform is needed: the way of thinking about the viability of sustainability needs to change because it is framed using a neoclassical economic discourse that is not symbiotic with sustainability and a theoretical framework that is inherently non-sustainable.

In this chapter, I discuss an approach to viability assessment and analysis that can be used symbiotically with sustainability. The Viability Analysis framework offered here brings biophysical and socio-cultural aspects into the process for evaluating viability of sustainability policy.

## 9.2 Background context

The ways in which the viability of policies are formulated and assessed are critical for sustainability policy. In contemporary policy approaches, the systemic parameters (which create non-sustainability) and the behaviours they validate (which are unsustainable) are filtered through a neoclassical economic viability construct as part of the policy process.

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the redistribution of sustainability. IN ABAZA, H. & BARANZINI, A. (Eds.) *Implementing sustainable development : integrated assessment and participatory decision-making processes*. Cheltenham, UK ; Northampton, MA, E. Elgar, for and on behalf of UNEP. P49

84 "Societal development is not steered from a single point, but from the interaction of state actors and interest groups, producers and consumers, scientists and the media, just to name a few. To influence long-term societal change, it is necessary to coordinate the actions of various actors at different places along the lines of collective strategies." VOSS, J.-P. & KEMP, R. (2006) Sustainability and reflexive governance: introduction. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar. P16

Biophysical viability is usually discussed in terms of human impacts on the biophysical dimension: that is, as population, consumption and contributors to waste and pollution. This approach leads to state of environment reports and sustainability strategies that focus on these aspects of contemporary problems. While this approach provides important data for understanding the extent and significance of issues, it does not address the persistence or pervasiveness of the issues. The issue with this approach is that it does not differentiate between humans as biophysical creatures, and humans as a species that has consciousness with the capacity to construct invisible meanings through abstraction and other 'mental techniques' (Piattelli-Palmarini, 1994). Humans are generally acknowledged to be *homo sapiens*, but their special capacity to create abstract domains that can justify a large range of behaviours and beliefs seems to be excluded from analysis. Thus, rather than framing the relationship between humans and their environment in purely biophysical terms, the Viability Analysis approach suggested here frames the relationship in terms of a biophysical-abstract interaction so that the role of conscious constructs can be incorporated into policy analysis. It provides scope to compare the biophysical aspects required for systemic viability with the abstract socio-economic and cultural constructs of what constitutes viability. This is seen as a way of moving sustainability policy analysis into a new framework that engages with the extra-ordinary powers that humans have to create worldviews with their consciousness. It is offered in the hope that it will also awaken the notion that humans have the capacity to move out of crisis situations – as the imperatives for effective sustainability describe – through cognitive, conceptual, ontological and epistemological change.

The focus on the interface between the biophysical and abstract domains avoids the need for the artificial and unuseful intellectual constructs of natural, human and social capital<sup>85</sup>. Viability can be constructed within each domain and maintain its scientific integrity. Unless the systemic parameters are changed to make them symbiotic with sustainability parameters, unsustainable behaviour will be

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<sup>85</sup> The terms natural assets, human capacity and social capacity are preferable to me because they convey the incommensurability of the descriptions.

perpetuated, the imperatives for effective sustainability policy will not be met, and threats to human and ecological wellbeing will continue. The imperatives for effective sustainability suggest that policymakers and the broader community need to avoid the delusion that traditional analytical tools, ways-of-thinking, or being, or addressing issues will provide sufficient pathways soon enough to deliver sustainability (Roe, 1998).

The idea of linking economics and environment for policy purposes is not new. However, envisaging the relationship as a dynamic interface between the biophysical domain in which humans live (and on which they are dependent) and the abstract domain in which humans create meaning, significance and rationales for behaviour and activity is not found elsewhere.

### **9.3 The viability Concept**

Viability is a crucial concept that affects the formulation and implementation of policy. It is used to explain or ratify the legitimacy and worthiness of policy proposals. Viability constructs are conceptual. Bell and Morse (Bell and Morse, 2003) explain that “reality in qualitative research is understood to be a social construct” p32.

Viability is a descriptive concept, as well as a cognitive tool for describing an ongoing condition of survival, or systemic state of being.

Espinosa and Walker (Espinosa and Walker, 2011) explain the pioneering work on systems approaches to viability by Stafford Beers:

*The Viable Systems Model (or VSM), developed by Stafford Beer, is one of a number of theories that takes its inspiration from the natural world. The approach is to look at the way natural systems work, try and understand the principles of operation and then to see if they have any use in the design of social systems and institutions. ... A viable system is defined as being 'capable of independent existence'. It remains in touch with, and adapts to, a continuously changing environment, while maintaining its identity. A viable system co-evolves with its environment: it adapts to it as this environment changes. It needs to be autonomous in order to be able to adapt quickly to changes in the local environment, but must also be able to keep a healthy relationship with the rest of the systems it contains and is contained within. All living systems are viable, while most machines are not: they don't repair themselves or run away when a room catches fire. p28*

This is a very competent description. Of particular interest is the comment that systems must have a healthy relationship with the other systems to which it relates.

#### **9.4 The need for a changed approach to viability assessment**

It is obvious that for policy to facilitate sustainability, the parameters by which viability is constructed need to be symbiotic with sustainability. If a non-symbiotic construct is used to calculate viability, then the consequence will be policies that perpetuate unsustainability.

The foundations of economic policy pivot on the conceptualisation of viability. In the neoclassical economic approach, non-economic phenomena affecting sustainability are included only if they are reconceptualised to suit the economic paradigm. However, as explained above, there are no criteria for assigning value to ecological assets (i.e. natural capital) that makes natural capital commensurable with human-made capital. That is, the neoclassical economic approach to sustainability, based on managing stocks and flows of natural capital, is not useable outside of its own framework. Discussions about preservation of aggregate levels of natural plus manufactured capital, or maintaining stocks of natural and manufactured capital at their present levels (Gallopín, 2003) are meaningless.

Christensen (Christensen, 2001) writes:

*A biophysical and ecological approach to economics suggests that a first task of economic theory should be the development of the production foundations of economic activity. Neoclassical theory cannot provide these foundations. In the first place, it lacks any realistic treatment of production processes. Pp16-17*

The idea of a dynamic approach to economic viability accords with Bromley's (Bromley, 2007) perspective that:

*The economy is always in the process of becoming, and it therefore follows that individual ends (and appropriate means) are themselves always becoming. The problem of addressing sustainability in a policy sense concerns how to avoid the imposition of a static goal into a dynamic evolving process. p679*

The parameters that guide the construction of viability also vary according to context: sustainability is grounded in biophysical/ecological parameters such as the

laws of thermodynamics and other limits, whereas economic parameters are derived from abstract human socio-cultural constructs.

It follows that they can be changed through processes of reconceptualisation and cognitive development. That is, by changing the way we look at issues, and how and what we ascribe as being significant allows us to reconceptualise what we consider viability to be. If viability is framed within a sustainability context, it can be perceived as a multi-faceted concept.

The crucial step is to frame the relation between biophysical viability and humans in terms of the way the concept of viability is constructed. That is, to address the relationship in terms of biophysical viability of the world in which humans exist, and the abstract viability construct by which humans establish and manage priorities for action. Comparison of the relationship, or interface, between the two viability constructs allows analysis to be undertaken in terms of overall 'health' or symbiosis of the nexus and provides a more holistic perspective on sustainability issues. The relationship between the way viability is constructed in the biophysical domain – based on scientific understanding – and the way it is constructed by humans within their economic, social and cultural domain – can be analysed to see the extent to which they are symbiotic and co terminal with sustainability. And if not, how the human constructs may be reconceptualised or changed through cognition (ways of thinking), epistemology (ways of knowing) or ontology (ways of understanding).

### **9.5 Viability analysis: an analytical framework for sustainability**

I present here a framework for conceptualising viability analysis. It is a generalised conceptual framework that is designed to be populated with existing tools used in sustainability analysis and policy, such as sustainability assessment, that do not prosecute a quantitative approach. Most importantly, it reframes the relationship between sustainability and economics so that economic issues are analysed within a sustainability-informed framework rather than sustainability being analysed according to economic parameters. It is a simple but profound conceptual re-organisation of the relationship between the two domains. It is a return to the notion of economics as *oeconomie*, which focuses on management of the

household, and away from the neoclassical economics of *chrematistics*, which focuses on accumulation and expansion to overcome scarcity.

Svedin (Svedin, 1991) suggests that better understanding of the problems with the “interface between natural science and social science” is the key to “better penetration of environmental problems” (p5). This perspective is reinterpreted here in terms of the interface between natural science perceptions (the biophysical domain) and social science perspectives (the abstract domain). It is called the abstract domain because cultural, social and economic aspects are human constructs, developed through abstract reasoning of one sort or another. The layers in which sustainability issues manifest are nested within each domain.

In the Viability Analysis framework, viability constructs are analysed at two levels: the interface between the biophysical world and the abstract domain (that is, economic, social, and cultural constructs are essentially abstractions), plus the *interactions* within and between the layers of sustainability existing in each domain (social, cultural and economic layers in the abstract domain, and ecological layer in the biophysical domain)<sup>86</sup>.

The biophysical aspect is developed from scientific and traditional understandings; the socio-cultural aspects are based on abstract constructs developed epistemologically from, amongst other things, language, symbols, social conventions, myths, metaphors and cognitive traditions.

Analysis of the different viabilities as well as the interactions, synergies and conflicts between the domains and among the layers, becomes the central task for creating sustainability policy. Policy formulation becomes the process of finding strategies that create synergies between the layers and domains that constitute sustainability. Viability in both biophysical and abstract domains and the interface between the two domains needs to be considered so that the full picture is used for policy.

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<sup>86</sup> “Human life, without any question, is both a biological and a socio-cultural affair. The latter dimension of human life is undeniably grounded in and importantly conditioned by the former.” SCHACHT, R. (1990) Philosophical Anthropology: What, Why and How. *Philosophy and Phenomenological Research*, 50, 155-176. . P168



Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) argue that monetary and biophysical approaches to sustainability get different and partial perspectives:

*Tools falling within the two categories can offer two legitimate perspectives for sustainability assessment and it would be not appropriate to exclude any of their findings in favor of the other. p253*

In other words, the two domains need to be acknowledged, but also the interface between the two needs to be brought into the analytical process. This approach to viability acknowledges the complexity of issues, and the complexities of the interactions between the domains and layers in which the issues manifest. As Svedin (Svedin, 1991) states:

*Environmental, socio-economic and cultural forms of sustainability mutually enforce each other in complex ways. There are no easy causal links to be identified, rather patterns of causally enabling settings. Often this takes the form of disrupting vicious circles. This web of interlinkages has to be recognized from both sides. The economy side has to encompass more strongly the absolute need for certain environmental functions and making room for it in economic theory. p10*

This multi-perspective approach to viability allows policy to be framed as dynamic comparative analysis that provides options for consideration based on sustainability-informed criteria. In this approach, viability is considered within the domain in which the activity is occurring, as well as in relation to other domains, dimensions and layers in which it may have an impact<sup>87</sup>. Sustainability policymakers are able to consider viability constructs from a range of approaches, not merely economic viability. Analysing the interaction between viability in the abstract and biophysical domains is an opportunity for policy-makers to consider the form as well as the content of the interaction. It creates a formal space for reflexivity, transdisciplinarity and sustainability learning.

The Viability Analysis approach can be used in conjunction with other systems approaches, such as those proposed by Gallopin (Gallopin, 2007) who focuses on vulnerability, resilience and adaptive capacity of systems. For instance, three states

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<sup>87</sup> A multidimensional approach to transition management developed by Loorbach et al. LOORBACH, D. (Undated) Governance and Transitions: A multi-level policy framework based on complex systems thinking. *Conference on Human Dimensions of Global Environmental Change*. Berlin. is discussed below.

of stability are identified that can be used to frame analysis within the Viability Analysis framework:

1. Local stability – changes in state near equilibrium point (engineering resilience)
2. Changes in state between attractors within a given stability landscape (ecological resilience)
3. Structural stability – changes in the stability landscape (robustness/vulnerability) (Gallopín, 2007) p33.

The interface between the two domains provides a strategic context in which the respective viabilities can be analysed within the context of holistic systemic perspectives. If environmental degradation is dominant or emerging, the policy can, for instance, work to de-emphasise extractive resource-exploiting or waste-creating economic activities. Policy derived in this broader context will allow economic growth to be more qualitative and targeted for enhancement and improvement because it is tempered by viability constraints within a biophysical context.

Espinosa and Walker (Espinosa and Walker, 2011) explain Beer's description of a viable system as:

*... a system able to adapt and to thus maintain an independent existence as it co-evolves with a changing environment. A viable system is always embedded in and composed of other viable systems: one of the biological mechanisms for survival is to develop viability in every part of an assembly of nested viable systems. p13*

The Viability Analysis framework dissipates the tendency for economic interpretations to dominate sustainability considerations.

The Viability Analysis framework requires policymakers to continually assess the multidimensional aspects of biophysical and abstract parameters in an open-ended, dynamic framework. It requires that viability constructs be framed with concepts and methodologies that are commensurable with other sciences and reflect contemporary scientific understandings. It avoids the tendency for the natural world to be reconceptualised as economic phenomena (capitalisticism), or be

framed in 19<sup>th</sup> century metaphors and aphorisms, or succumb to inadequate methodologies such as contingent valuation, maximum sustainable yield, etc.

Using the Viability Analysis approach requires conceptual and cognitive change, not merely reform or augmentation of the neoclassical economic perspective by ascribing monetised values to qualitative non-market variables. Developing the capacity to adopt this dynamic perspective is one thing, but the other is to be able to accept that change is dynamic. This dynamic is more than the concept of unstable equilibrium; it is an inherent characteristic of dynamic systems that needs to be central to policy analysis for sustainability. The analytical framework by which sustainability policy is formulated needs to incorporate the elements of constant change processes, such as expansion and contraction, increase and decrease, chaos and order, progress and expansion, etc. The neoclassical economic approach is essentially one of countering these natural dynamics and pulses: slowing down booms and stimulating recessions. The Viability Analysis approach allows the qualitative aspects of these change processes to frame the context in which policy is created; the emphasis is to work with the current conditions in a steering manner, rather than the counter-cyclical disposition of neoclassical economics. Continuous change is a qualitative aspect, not a quantitative phenomenon. It requires cognitive and conceptual changes to the analytical paradigm underpinning policy processes to accommodate these qualitative perspectives.

#### **9.5.1 The viability analysis framework: graphical illustration**

The Viability Analysis framework is illustrated with images adapted from graphical presentations of chaotic attractors (Moon, 1992). Froger and Zyla (Froger and Zyla, 1998) describe the common principles of system dynamics modelling as:

*(1) taking into account the main characteristics of complex systems such as irreversibility, interdependencies, time-delays and feedback phenomena;*

*(2) tackling a deeper reflection about decision-making processes and relations between knowledge and action. (Froger and Zyla, 1998) p287*

The Viability Analysis framework is constructed in two stages. The first, as a condition existing within, and between, four nested layers in which issues occur:

economic, social, cultural and ecological (See Figure 9.1). Each layer has its own conditions for viability, and each layer interacts with other layers.

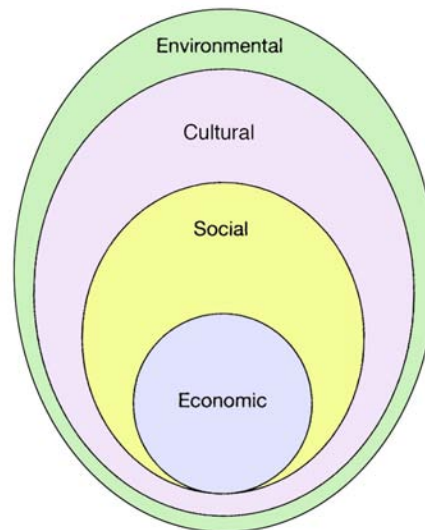


Figure 9.1: Nested Hierarchical Relationship of Sustainability Layers with Economics (adapted from (Brady, 2005) p43

The Viability Analysis approach is designed to allow comparative analysis of the viability of various policy options across nested hierarchies and domains.

Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) explain the tendency for complex systems to be nested:

*... human societies are complex adaptive systems which are in turn embedded in more complex adaptive ecosystems... It becomes obvious that the interactions across scales become of primary importance. However, tools that focus on a single issue and are based on a steady-state viewpoint interpret changes in the system as incremental and disregard the interaction across scales ... by making a distinction between ordinary and emergent complexity claim that emergent complex systems such as the ones mentioned earlier cannot in most cases be fully explained mechanistically and functionally as ordinarily complex systems because at least some of their elements possess individuality, a degree of intentionality, consciousness and morality amongst others. p248*

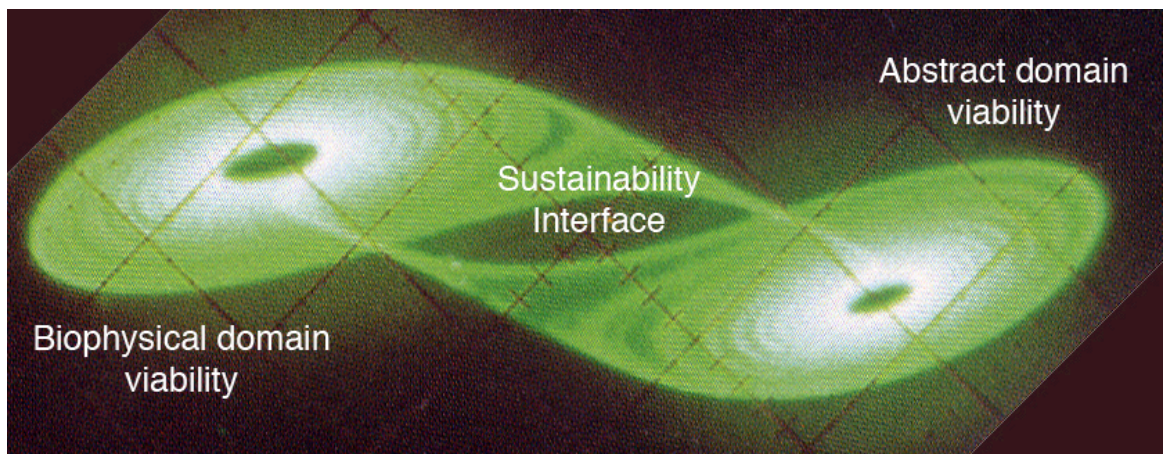
Sachs (Sachs, 1999) (p31) explains that effective policy becomes possible when sustainability criteria are met simultaneously in each 'relevant dimension'<sup>88</sup>.

<sup>88</sup> Sachs' SACHS, I. (1999) Social Sustainability and Whole Development: Exploring the Dimensions of Sustainable Development. IN BECKER, E. & JAHN, T. (Eds.) *Sustainability and the social sciences : a cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. New York, Zed Books. four dimensions are ecological, economic, political and socio-cultural P32). The adding of political dimension and the grouping of social and cultural do not detract from the validity and relevance of the perspective in relation to Viability Analysis. I prefer to regard politics as a subset of

The second stage of the illustration portrays these multidimensional and dynamic aspects by rotating Figure 9.1 and extruding it into 3 dimensions. That is, the environmental becomes the biophysical domain (to the left) and the cultural, social and economic become the abstract domain (to the right). This allows the interface between domains to be illustrated with the viability considerations within and between the various layers in which issues are nested (Figure 9.3).

A dynamic, interactive double helix was used as a metaphor in creating this illustration. The actual graphic was adapted from computer generated chia attractors (Moon, 1992). Sustainability is envisaged as a dynamic interface of two strands of reality – biophysical and abstract – occurring at several nested levels. The graphic can be interpreted as a fluid dynamics approach to illustrate the interactions between the biophysical domain (notated as environmental in Figure 9.1) and the abstract domain representing the nested hierarchy of cultural, social and economic layers from Figure 9.1.

The key conceptual contribution of this nexus between biophysical and abstract domains is that it differentiates between humans as biophysical creatures, and humans as creatures possessing consciousness and the capacity of creating invisible worlds of meaning and ritual that augment human behaviour beyond instinctual responses. These abstract constructs of human consciousness however, may or may not be aligned with sustainability (Diamond, 2005, Ponting, 1992).




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social, cultural and economic domains. Such differences are acceptable if one takes a pluralist approach to sustainability: no one way is absolutely correct.

Figure 9.2: The Viability Analysis interface: a representation of sustainability as a fluid dynamic interface between (abstract) economics and (biophysical) environment. (Adapted from (Moon, 1992))

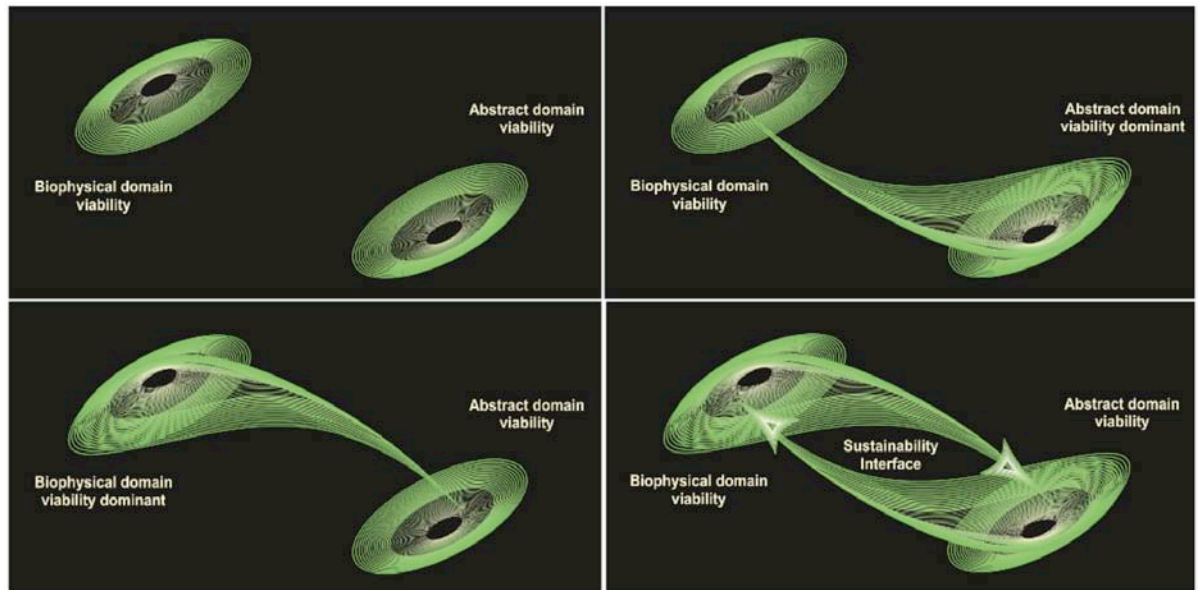


Figure 9.3: The Viability Analysis interface dynamics, showing (first line from left) the two domains in isolation, the condition of abstract dominance, (second line from left) the condition of biophysical dominance, and the sustainability interface in which viability in each domain as well as the interface is part of the policy framework.

The Viability Analysis framework moves analysis out of abstract self-referentialism of neoclassical economics and provides a way to analyse sustainability policy in terms of the abstract-biophysical interface. It provides scope for policy makers to identify imbalances and suggest ways in which economic activities can be maintained at a sustainable level. As Slife (Slife, 2004) explains:

*Abstract beliefs and values exist and are important to individual living, but they are not ontologically fundamental. Ontologies imply or assume a basic ethical or moral framework (similar to philosophy). p167.*

Although scientists use abstract concepts and methodologies in their attempts to understand the meaning of the biophysical world, it remains true that the construction of theories and approaches is based on understandings that are framed by the limits and dynamics of a reality that existed before, and will exist after humans. Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) explain that biophysical aspects, by themselves, are insufficient for assessing or analysing sustainability:

*.... biophysical models are purely descriptive and as a result they cannot give comprehensive answers to normative issues such as sustainability. p253*

### 9.5.2 The workings of viability analysis: domains and interface

The Viability Analysis approach focuses on the interactions in and between layers in each domain, as well as the interface between two domains. It provides a context for analysing the flows between the two domains and among the levels of sustainability within those domains in a way that gives due accord to biophysical limits as well as abstract aspirations and beliefs. It accords with the fundamental notion that viability in the biophysical domain sets the environmental limits to human activity, and viability in the abstract domain is derived from the economic, social and cultural constructs humans create to organise and govern their being on the planet. It provides a relational framework to analyse anthropomorphic reality as ordained by cultural authority – in which social mores, cultural practices and economic rationality are encased – and the biophysical limits and dynamics that exists regardless of what humans believe or practice<sup>89</sup>.

Weaver and Rotmans (Weaver and Rotmans, 2006) explain the importance of analysing systems to find ‘unsustainability problematiques’, and the need to use transdisciplinary, multi-dimensional ‘thought tools’ in an integrated systems analysis to perform ‘cross-cutting analysis’ to help root out tacit biases arising from common, non-reflexive analytical frameworks.

Viability Analysis is not a tool designed to optimise system dynamics, but rather to conduct analysis with a view to steering policy toward amelioration of the issues and on to a pathway to sustainability. As discussed above, optimality and equilibrium are not valid objectives or analytical concepts in systems analysis.

Rammel and van den Bergh (Rammel and van den Bergh, 2003) explain that:

*In general, evolutionary systems do not relate to stability in a static sense as they are faced with moving equilibria and the dynamics of coevolutionary interactions which cannot be foreseen ex ante. Given this permanent process of unpredictable change any kind of optimising must be understood as local and myopic.... If optimality exists it will be temporary, because through evolution, selection and innovation, and environmental change, including coevolution, it is easily transformed into maladaptive traits... Under such*

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<sup>89</sup> Ponting PONTING, C. (1992) *A green history of the world*, London, Penguin. describes the demise of humans on Easter Island in terms of cultural practices that were adhered to in spite of the biophysical and social consequences: i.e. extinction. Such an outcome can easily follow from a culture that derives policy within self-referential, inherently non-sustainable paradigm.

*conditions, diversity is a key element of long term stability and even survival. This holds equally for biological and economic systems...p127*

The notion of policy as a process of 'steering' is an essential aspect of governance for sustainability (discussed below). The Sustainability Institute describes some of the questions that might be asked, and the insights that may be obtained from a Viability Analysis approach:

*Typical insights include: "How actions and interventions and policies will affect outcomes in the short and long term; What actions or strategies really help, and which are just treating symptoms; Unanticipated side effects of actions; What new choices are possible Support for goal-setting; discovering effective goals; Highlighting assumptions that underlie actions in the system; How the system works." (sustainabilityinstitute) NP*

The Viability Analysis approach provides a context for analysing the dynamics and multidimensions of issues within a sustainability framework. It reduces the likelihood of methodological biases because a focus on the activities within and between each layer, and between the biophysical and abstract domains, and becomes integral to the policy process. The systems-based modelling reduces the opportunities to exclude relevant variables because transdisciplinary approaches are required. This removes the likelihood of abstractionist self-referentialism creating myopia among policymakers. As Harris (Harris, 2007) explains:

*Now there is a demand for integration, systems thinking and transdisciplinary science, which requires cross- and interdisciplinary discussion, fusion, agreement and innovation. .... Some scientists with a strongly reductionist and narrow disciplinary focus will never manage it. p246*

The Viability Analysis approach may reveal that particular strategies or actions are causing the resilience of biophysical capacities to be compromised or transgressed. For instance, economic viability required to keep a trawler in action may transgress the biological viability of the fishery. In such a case, the economic-based interpretation of viability is deemed to be not sustainable and adjustments can be made to restrict fishing in favour of biological sustainability. It may be argued that this already happens in good policy processes, but the more likely response is that the biophysical transgressions are analysed with a neoclassical economic interpretation: a cost benefit analysis will be constructed to work out the cost of sustainability and to decide how much sustainability can be afforded. Frame and



Brown (Brown and Frame, 2005) provide an excellent summary of the problems with CBA. O'Connor (O'Connor, 2002) explains how economic valuation methodologies have extended cost-benefit analysis across time (i.e. discounting the future) and domains:

*... through the attempted quantification of environmental damages and of economy-environment trade-offs through time with 'discounting'. Yet this practice does not reconcile future interests with the present; it simply discounts future values. Conversely, the less the future is discounted, the more weighty in the cost-benefit scales become the imponderables of uncertainties about longer-term change. Given the distributional conflicts between present and future, and the ethical and culturally based disagreements between existing interested parties, the cost-benefit 'optimizing' approach becomes fairly useless as a guide for decision making.*  
p32

The problem is that the methodologies underpinning these analyses are derived from an episteme that is not symbiotic with sustainability. That is, they can only reveal what is sustainable from the simplistic neoclassical interpretation of sustainability. Invariably, when there is conflict between system sustainability and economic sustainability, the latter prevails: neoclassical economics tells policy makers how much sustainability can be afforded. As well as the arrogance of economism, this is a disastrous approach because the interpretation of sustainability being used is grossly inadequate for managing the complexity of the issues involved.

In the Viability Analysis approach, sustainability policy needs to be simultaneously viable in all layers as well as between domains. This is a condition of system health and durability. If any aspect is deemed not viable, then the policy needs reconfiguring if social, cultural, environmental and/or economic collapse is to be avoided. Such collapses can happen quickly, be triggered non-sequentially, or result from a cascade of small causes. Kohn (Kohn, 1999b) explains that systems can flip if they lose their capacity to accommodate shocks that are caused by internal or external factors. Such a flip may result in a new state that has little resemblance to the previous system.

Without multidimensional systemic sustainability, collapse is a realistic possibility (Diamond, 2005).

### **9.5.3 Implications for economic analysis: using the viability analysis framework**

In the Viability analysis Framework, economic viability is part of the analytical process, but it is not the dominant determinant of viability. Economic considerations remain an integral part of the viability analysis approach, but they are no longer the final arbiter of viability. Nor does economics control the parameters by which issues are filtered or framed for policy consideration.

The Viability Analysis framework requires that the full suite of sustainability perspectives is encompassed within the analytical process. In the words of Gasparatos, El-Haram and Horner (Gasparatos et al., 2009), a multidimensional interdisciplinary approach is needed that

*... incorporates insights from a plethora of academic disciplines including the natural, engineering and social sciences. p246.*

The diversity of issues that need to be considered emphasises the need for learning as a critical part of the sustainability policy process. This emphasis on learning is an acknowledgement of the spectrum of uncertainties that characterise contemporary issues. It is supported by the precautionary principle and part of the sustainability policy process, discussed below.

The cognitive and conceptual changes required for Viability Analysis are an acknowledgement that complex issues demand respectful consideration in all their aspects. As Kane (Kane, 1999) states:

*The biosphere itself is made of components which operate on very different scales of geographic scope and time. Add to that the complex nature of human societies with all their various layers, whether social, economic, ethical, technological or biological, and it is easy to understand why the general notion of sustainability has been difficult to operationalise. Each layer of human existence takes on its own dimensions of time and spatial impact, and decisions made with respect to one layer may have unpredictable consequences for others. p20*

#### *9.5.3.1 Transcending the economic interpretation of sustainability*

Removing the economic interpretation of sustainability as the dominant underpinning of policy viability provides capacity for economic activity to be integrated with conditions necessary for ecological, cultural and social viability. It allows policymakers to develop new perspectives on aspects of economics that

have dogged that discipline over the years. It provides a way for economists to conceptually reframe their discipline.

#### *9.5.3.2 Attributes and metaproperties: qualitative viability analysis*

The Viability Analysis framework allows economic activities to be described with sustainability-informed attributes and metaproperties that reflect the aspects and impacts of activities from a sustainability perspective. The terms ‘aspects’ and ‘impacts’ represent two important dimensions in relation to sustainability-informed management. Aspects refer to the activities of the firm that may impact on the broader environment and community, impacts refers to the nature and extent of those impacts.

Assigning attributes and metaproperties allows qualitative data to be included in mainstream sustainability considerations. For example, impacts of activities can be described by applying metaproperties, such as energy efficiency, resource use, recycling, social justice, etc to describe the impacts. In turn, these metaproperties can be assigned metatags that can be included in databases that link to the national accounts system and inform policy makers. How this can be done is discussed in the next chapters. The powerful computing capacity, and the many options for presenting information offered by digital technologies now available, means that decisions no longer need to be constrained by mere quantitative considerations and interpretations.

In a sense, the assigning of multidimensional attributes and metaproperties, discussed below, is a qualitative extension of the neoclassical economic conceptualisations between stocks and flows. The difference is that these qualitative data are grounded in perspectives that are commensurable with other sciences, not merely abstract constructs.

The Viability Analysis approach is different because the descriptions of economic activities are augmented by metatags derived from sustainability parameters; they are not distilled into a mono-dimensional unit of account by a monetisation process. They are not processed through a price mechanism – real or surrogate – to distil a monetary value. Instead, metatags attribute properties that are included as

qualitative aspects of the analysis because they relate to overall system dynamics and function. As described above, there are many aspects of activities that are left out in the monetisation process, both methodological (such as contingent valuation) and ontological (such as deciding in which specific currency prices are to be measured, and at what exchange rate). These are critical issues for establishing viability for sustainability policy, and to ignore them because they are conceptually too hard is to abrogate responsibility.

#### *9.5.3.4 Sequencing options as the basic economic management challenge*

Encasing economics within a sustainability-informed, systems-based ontology creates the opportunity to reframe the scope and purpose of economics. As Sachs (Sachs, 1999) states:

*...it is maldistribution and not scarcity that lies at the root of the [economic] problem. Under-consumption and overconsumption, underdevelopment and overdevelopment are two sides of the same coin. p27.*

Reconceptualising the economic problem in terms of sequence rather than scarcity has important implications for a systems-based approach to sustainability. Focusing on sequences rather than overcoming scarcity allows economics to maintain a role as prioritiser of events, but within a dynamic framework that is more in accord with complex adaptive systems. Roe (Roe, 1998) explains that complex adaptive systems have unfamiliar, unplanned and unexpected sequences that may not be immediately visible or comprehensible, compared to linear systems. However, by framing economics as a sequence analyst within a complex system, perhaps the impositional aspects of economic analysis will be kept humble. That is, the unpredictability of the sequences in a complex adaptive system will keep economics supple and ready to respond when unexpected outcomes emerge. Economists would engage in iterative analysis to provide priorities and options, based on qualitative and quantitative analysis undertaken within a precautionary, adaptive management and transition management framework.

A systems approach requires holistic perspectives. Within a system there are no scarcities, just limits and different distributions of agents and elements. This creates

the opportunity to make a conceptual shift away from scarcity or insufficiency as the central problem of economics to a focus on managing economic activity within biophysical and socio-cultural limits. It also offers the chance to reframe the economic problem.

Neoclassical economic theory frames the economic challenge as one of overcoming scarcity; consequently expansion is the way in which scarcity is ameliorated (Kohn, 1999b). The epistemic underpinnings of the neoclassical framing approach do not accord with a systems perspective because a system does not have scarcity *per se*, only different allocations of agents and factors. From a holistic systems approach – such as that used in sustainability analysis – there are merely different distributions of elements within the system:

*Systems thinkers write of ‘emergent or nonreducible properties’; that is, the characteristics of the system are not predictable from a knowledge of its constituent parts, and thus a solution cannot be identified and guaranteed through disaggregation. Ecosystems possess spontaneous or rejuvenative tendencies manifested in homeostasis, adaptiveness, and succession that ensure that the quality and scope of problems will not remain static. These attributes allow ecosystems to cope with problems without human intervention until challenges overwhelm their capacity to repair themselves and adapt. Therefore, policy solutions must take into account the capacity of natural and human systems in combination to cope with human induced problems. (Brown, 2000) p578*

A scarcity-based approach to economics is inherently a partial analysis; a legacy of anthropomorphic static analysis. It reflects a 19<sup>th</sup> century mechanistic worldview that there is ‘not enough to go around’. A sustainability-informed systems-based approach indicates that it is more accurate to frame issues in terms of limits, allocations and distributional aspects.

Using sequence rather than scarcity as the central premise of economic management, the market metaphor is adapted to be more like the central processing unit of a computer (CPU)<sup>90</sup>. Extending this analogy, the role of economics can be seen as one that helps devise optional sequences by which

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<sup>90</sup> The CPU in a computer exists because everything cannot be done at once. The CPU does not ‘control’ what is to be done, because that is decided by the operator. The CPU does not do economic analysis of what is to be done, it merely facilitates an ordered sequence for tasks – according to the limits/capacity of the CPU – that are derived from the programmed instructions that frame the computer’s functioning.

actions can be done within the limits and parameters prescribed by a sustainability-informed policy framework. In particular, there needs to be cognisance of the fact that resources are limited, ecosystem function can be damaged irreversibly, and that substitution is not a viable assumption for analysis of a living system.

To apply a scarcity-based approach is to limit the options for sustainability policy: a system can adapt to sequences; opportunity cost no longer dominates options for action. QMA processes do not dominate analysis of options. Frame and O'Connor (Frame and O'Connor, 2011) distinguish system complexity and ethical complexity as two thresholds "beyond which assessing trade-offs, choices or consequences of choices through monetary measures alone becomes difficult to justify (p1)". The quantification of opportunity costs in relation to sustainability values is described as an impossible task.

By contrast, qualitative aspects are being recognised among contemporary mathematicians as an emerging property of numbers. For instance, Stewart (Stewart, 1998) explains the changing perception of quantification among mathematicians and physicists:

*To Rutherford, [qualitative] meant 'vague generalities'. To today's mathematicians, however, [qualitative] means 'features that are conceptually deeper than mere numbers'. p246*

When properly contextualised within a complex adaptive system framework, the necessity of qualitative data for effective sustainability policy becomes crucial. The perpetuation of the idea that monovalued quantification is 'hard' and multidimensional qualitative is 'soft' – is a major conceptual and cognitive impediment to sustainability policy.

Kastenberg, Hauser-Kastenberg and Norris (Kastenberg et al., 2005) suggest that tools for systems analysis need to be able to accommodate a structure of subsystems, emergent properties and pluralist perspectives. This is a challenging list, but the newly available computing power for working with relational databases, digital mapping applications, digital storage capacity, photographic and graphical animations, global internet and intelligent search engines to quickly find and

organise data, means that there are vastly more powerful tools available than the meagre power of calculation that was all that was available until the second half of the 20<sup>th</sup> century. The move out of a QMA-based methodology is merely an acknowledgement of the advances that have been made. The tools exist but it is the official methodologies that are lagging and being further constrained by use of an outmoded epistemological framework to frame analysis.

The focus on scarcity affects the way contemporary neoclassical economists frame approaches to sustainability issues such as peak oil and climate change. For instance, Turner (Turner, 2012) suggests that collapse is more likely to result from scarcity of resources than from climate change<sup>91</sup>. However the analysis does not mention the capacity of ecosystems to absorb waste as an issue and possible contributor to collapse. The conclusion is that resource depletion “deserves more attention than climate change”, but no evidence of the relative attention given to either case is given. It is an example of how framing issues in a scarcity-based economic discourse generates the logical conclusion that it will be resource scarcity that is likely to cause collapse, not ecosystem dysfunction or social unrest. The focus is incomplete because the analysis is framed in terms of economic collapse, not a full sustainability-informed perspective.

Scarcity is not a concept that embraces the full suite of interactions possible in a systems approach. It is essentially an anthropomorphic perspective. According to Andersen, Parker and Chen (Andersen et al., 2006):

*There is not one unique subdivision of the world into entities... the world may be perceived as consisting of different entities dependent upon which features are considered important... p170*

A systems approach can still address issues of scarcity and maldistribution. However the issues are contextualised within sustainability parameters, such as social justice, ecological health. It provides a broader range of policy options and strategies. For instance, reallocation of resources may create synergies that effectively overcome

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<sup>91</sup> “Following the corroborated standard run scenario, the issue of resource constraints is a greater problem than climate change, though the latter has received more attention in scientific and public debates.” TURNER, G. M. (2012) On the Cusp of Global Collapse? Updated Comparison of "The Limits to Growth" with Historical Data. *GAIA*, 21, 116-124. P123

scarcity *without* the necessity for economic expansion. Sachs (Sachs, 1999) (p31) explains how social justice and equity can help alleviate socio-cultural issues<sup>92</sup>.

Bringing limits and sequence to the centre stage of economics is a reconceptualisation of scarcity. It moves scarcity beyond both notions of insufficiency and limitless material accumulation. Expansion is not the only way of managing scarcity. Qualitative changes can provide options to alleviate scarcity by working with what is to hand and fostering creative responses. The focus shifts to what can be done to what is possible and how goals can be achieved with what is available in the given context.

It provides scope for a shift away from consumerism as the driving force of markets and *homo oeconomicus* as the basic descriptor of human behaviour. In a sustainability approach *homo sapiens* and *homo oeconomicus* need to work together to find the most appropriate way of doing things, according to time constraints, seasonal conditions, urgency, and the order in which they need to be done. It is an overturning of the assumption of consumer sovereignty.

### 9.6 Conclusion

The Viability Analysis approach provides an analytical framework for a reconceptualised sustainability-informed economics to be brought into the policy process. It is a movement of economic analysis out of the constraints of Cartesianism into system dynamics. Many of the analytical skills acquired by conventional economists will be applicable in this framework; the difference will be that the analysis will be framed within a context of dynamic sustainability considerations.

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92 "In a pioneering study published in 1976, a team of Latin American scientists led by Amilcar Herrera demonstrated that in an egalitarian set-up the satisfaction of all basic needs in developing countries would require a GNP per capita three to five times lower than the one required if current income structures were maintained (Fundacion Bariloche, 1976). This goal could be achieved with moderate rates of growth on the condition of reducing non-essential consumption. In Latin America no more than thirty years would be needed. Another important conclusion of the study was that under prevailing conditions in most developing countries, increased foreign aid would have little or no effect on the living conditions of the majority of the population." SACHS, I. (1999) Social Sustainability and Whole Development: Exploring the Dimensions of Sustainable Development. IN BECKER, E. & JAHN, T. (Eds.) *Sustainability and the social sciences : a cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. New York, Zed Books. P31



The Viability Analysis framework requires that policy makers attend to the broader context and implications of their decision-making. It may be, for example, that contemporary policy needs to accentuate biophysical viability rather than short term exploitation of resources required by economic viability in order to remediate the legacies of 150 years or more of economic expansionism. A management-oriented sustainability-informed approach to economics may make such a policy possible without the drastic drops in living standards that the neoclassical economic approach would predict. We might find that we could all do less, better, and more often.

The rationale for Viability Analysis is derived from the evolved concept of sustainability which considers viability in each layer in which sustainability issues emerge as part of the analysis, as well as the interactions between the domains in which those layers abide. This is a dynamic multidimensional framework that supports the notion of sustainability as an open-ended, transdisciplinary learning process. Viability analysis provides a reconceptualised approach to economics in which economic viability is constructed in a multidimensional, multifaceted approach that is symbiotic with sustainability.

The Viability Analysis approach includes economic viability, but it reverses the convention that economic viability is the final arbiter of sustainability policy. In Viability Analysis, economics provides but one of the competing narratives for describing how the world works. Sustainability sets the terms for what is considered viable; economic viability does not dictate how much sustainability we can afford.

The Viability Analysis framework provides the analytical context for the sustainability-informed accounts discussed in chapter 12. In the next chapter, the ways in which accounting can be used as a tool to facilitate sustainability-informed economic policy are discussed.

## Chapter 10: Aligning the system of national accounts (SNA) with sustainability policy

### 10.1 Introduction

This chapter examines the possibilities of reconceptualising the system of national accounts and the ways in which such accounts could be used as a tool for facilitating effective sustainability policy. It includes discussions on the known and tolerated shortcomings of the existing SNA as well as the conceptual inadequacies underpinning the existing SNA methodologies. It looks at common approaches to SNA reform and explores why they remain marginalised by policy makers.

Bringing a qualitative dimension into accounting can be seen as a homecoming of sorts because the economic-accounting relationship had its origins in the biophysical world. As Schabas (Schabas, 2005) explains:

*The most detailed account of an oeconomy during the mid 18th century was the Linnaean oeconomy of nature, which encompassed human production, the web that joins humans and plants, the earth's surface (including fossils), and what we would now call the hydrologic cycle... p5*

Accounting has a forgotten role as a cultural narrative that was integrated in the biophysical domain. This aspect of accounting needs to be remembered and reconsidered.

Ormerod (Ormerod, 1994) reminds us that there is nothing "... immutable about the construction of the national accounts, about what does and what does not constitute economic activity" (Ormerod, 1994) cited in (Gleeson-White, 2011) p226.

Andersen, Parker and Chen (Andersen et al., 2006) explain that there are times when conventions and practices need to be challenged:

*... occasionally situations occur in which it becomes clear that something is wrong with the structure that our concepts give the world – that objects do not behave or situations do not develop as prescribed by the current conceptual structure. p172*

However, as explained in the preceding chapters, a change process is more than merely the substitution of one set of concepts for another. A systemic conceptual intransigence exists because new attempts at providing key national indicators

remain framed within the neoclassical economic interpretation of human activities, based on quantification, market-price monetisation and aggregation (QMA). Change agents need to account for the inertia that has become ingrained in neoclassical economics, and that the neoclassical economic episteme has become naturalised in the conventional cultural narrative. To overcome this intransigence, the existing approach to SNA needs to be reconceptualised within a sustainability-informed framework.

## 10.2 Background

Although accounting has come to be associated with purely quantitative processes the first definition of “account” in the Australian Oxford Dictionary (Moore, 1999) p8 is “a narration or description”. Similarly, “accountability” is defined as “being required to account for one’s conduct” (Moore, 1999) p9. The dictionary does describe accounting as a monetary or counting activity, but this is not given as the prime or only meaning. In contrast with the existing practice, it is concluded that a narrative-based conceptualisation of accounting is more appropriate for sustainability policy.

Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) explain that “accountants are increasingly required to wrestle with issues of measuring sustainability performance.” p246. The question is how can they deal with the multidimensional, dynamic, complex aspects of sustainability. Frame and O’Connor (Frame and O’Connor, 2011) explain that there is no common agreement among policymakers, for example, on how to match formal accounting approaches with the key sustainability principles of participation and governance. Effective sustainability policy requires indicators and assessment strategies that encompass many dimensions and scales: it needs a sustainability-informed accounting structure with a complementary policy framework. O’Connor (O’Connor, 2002) explains evaluating options across a diverse range of variables and dimensions – biophysical and socio-economic – may be achievable in a variety of ways

*... but this information cannot always be brought meaningfully into a single unit of measure, and even where a common unit is possible (e.g., energy flow units) this may not enable choice-informing judgments between alternatives.*

*p43*

Qualitative data are required to provide new dimensions and information to assist policymakers employ the broader interpretation of sustainability in their analysis. Continued quantitative augmentation of accounting data keeps the analysis in the same plane that the issues are created. A sustainability-informed system of national accounts (SISNA) requires that cognitive, conceptual and ontological changes be made to the conventional SNA approach. As with the general principles of transition management for sustainability, the art of change is to begin with what you have, from where you are.

The shortcomings of the conventional System of National Accounts (SNA) have been known since they were first published in the 1930s. Yet the debate about these inadequacies is repeated, as if knowing about the problem achieves some movement towards change:

*...[in] 2008 a US Senate Committee discussed the GDP's failure to measure environmental damage, poverty, income inequality, health and the quality of life, as well as the danger of using the GDP to express national wellbeing. (Gleeson-White, 2011) p246*

The French President Nicolas Sarkozy stated that:

*...the global economic crisis and fluctuating commodity prices of recent years have laid bare both the deficiencies of our accounting structures and our dependence on finite and fragile natural systems (Gleeson-White, 2011) p242.*

The founder of the 'State of USA', Chris Hoenig called the GDP "an artefact of a world before the Web" (Gleeson-White, 2011) p246.

The existing SNA is not meeting the standards required for sustainability. The SNA provides the framework and parameters for indicators, monitoring and assessment to establish the criteria by which the efficacy of sustainability policy is judged. Currently the SNA is framed within the paradigm of neoclassical economism. This means that monodimensionality and inherent non-sustainability sets the framework for accounting activities to inform sustainability policy.

Sustainability requires a move beyond the 1930s conceptual framework of SNAs to a framework that is more in accord with contemporary understandings of complex

issues. Most of the attempts at changing SNA focus on creating satellite accounts to augment the existing processes. However, such approaches are inherently ineffective because they are still framed within a neoclassical economic ontology. Lafferty and Meadowcroft (Lafferty and Meadowcroft, 2000) explain that governments tend to acknowledge the challenges but don't necessarily fully understand the implications, so that when economic aspects are challenged, sustainability goals are relegated to the background.

Effective change for sustainability requires more than reform or augmentation of the existing SNA. Stirling (Stirling, 2006) describes two main steps for augmenting and extending evaluation procedures beyond the quantification-monetisation-aggregation (QMA) procedures that characterise contemporary approaches:

*First, they should go beyond the reductive, aggregative, specialist analysis and extend to more qualitative, heuristic processes of social learning. Second, these procedures should be conducted in a more open, inclusive and accessible fashion, providing for engagement of a wider range of disciplines, a greater variety of institutions, a more diverse body of stakeholders and the more representative array of public constituencies. p252*

A sustainability-informed ontology is needed so that the taxonomy of a SISNA can be framed according to sustainability parameters, principles, perspectives and processes. Despite the critiques presented in the previous chapters, the reframing of economics is likely to be strongly resisted. The self-referentialism and the dominance of the neoclassical economic doxa among economists and policy makers inhibits the prospects of such changes being perceived as an opportunity for developing a more conceptually adequate approach to accounting for sustainability. Despite the strength of tradition, SNA are a human construct of the 1930s that has become culturally embedded; it is not inviolable, but rarely has the conceptual bases of the structure been challenged from a sustainability point of view.

### **10.3 Accounting and policy**

Accounting affects, and is affected by the ways in which issues are approached and framed. Crosby (Crosby, 1997) states that socio-cultural practices and conventions such as accounting affect our everyday lives more than we might like to think:

*Bookkeeping has had a massive and pervasive influence on the way we*

*think... In the past seven centuries bookkeeping has done more to shape the perceptions of more bright minds than any single innovation in philosophy or science. While few people pondered the words of René Descartes and Immanuel Kant, millions of others of yeasty and industrious inclination wrote entries in neat books and then rationalized the world to fit their books. p219-220*

Miller (Miller, 1994) describes accountancy as

*...a practical rationality governed by a strategic ambition, rather than ... a cohesive and more or less coherent body of knowledge. ... If accountancy is viewed as a techne, as an assemblage of devices and mechanisms that draws from such diverse sites as engineering and economics, then we can begin to appreciate the changing types of entities it seeks to bring into existence and to operate on, and the differing ways in which it seeks to act on the actions of others. We can begin to outline the particular form of objectivity that is proper to accountancy, and the different elements out of which it is fabricated. We can, that is to say, begin to explore the different ways in which accounting invents calculating selves and calculable spaces. p242*

Gleeson-White (Gleeson-White, 2011) explains that contemporary accounting practices are already normative, multifaceted, continuously adapting and demonstrably imperfect (See Table 10.1). Contemporary accounting is not the objective impartial yardstick as it is often portrayed and the profession has a wide range of perspectives and few unanimous agreements on crucial issues:

*Even accounting's most fundamental concepts and practices, such as income measurement and asset valuation, are based on uncertainties. Accountants still cannot agree on how to define income, the measurement of which remains one of the intractable problems in financial accounting theory and practice. (Gleeson-White, 2011) p218*

That is, accountancy is a normative and adaptive narrative, even though it carries the connotation of being an impartial yardstick. Interpretation happens on a daily basis<sup>93</sup>. The change process for sustainability will be enhanced with the overt acknowledgement that interpretation and inclusion of qualitative data are already employed in the SNA. Such an acknowledgement would remove the veil of pseudo objectivity and allow accountants to embrace a constructive role in sustainability

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<sup>93</sup> For instance, Gleeson-White GLEESON-WHITE, J. (2011) *Double Entry: How the merchants of Venice shaped the modern world – and how their invention could make or break the planet*, Sydney, Allen & Unwin. writes: "Nor is the crucial measurement of costs an objective process: costs are highly contestable figures and may result as much from the collusion or rivalries of firms as from any other actuality. Accrual (or corporate) accounting – the need to allocate revenues and expenses between accounting periods and to value assets and liabilities at the end of an accounting period – raises problems which have never been solved and are probably incapable of solution. GLEESON-WHITE, J. (2011) *Double Entry: How the merchants of Venice shaped the modern world – and how their invention could make or break the planet*, Sydney, Allen & Unwin. p219

policy. The envisaged moves to adapt the existing SNA to better accord with the normative aspects of sustainability policymakers do not undermine the fundamental realities of accounting in practice. The change process can be a transition, not schismatic, more a process of adapting existing conventions and working through the accounting practices as the normative procedures that they are. As Stiglitz, Sen and Fitoussi (Stiglitz et al., 2009) observed:

*..the time is ripe for our measurement system to shift emphasis from measuring economic production to measuring people's wellbeing. And measures of wellbeing should be put in a context of sustainability. p12*

<b>Table 10.1: Practical deficiencies of accounting: some examples</b>
"From the Industrial Revolution to the 21 <sup>st</sup> century, company financial accounts have painted misleading pictures by manipulating expense and revenue figures and using complex business group structures to obscure the true financial condition of an organisation." (Gleeson-White, 2011) p200
"In the Royal Bank of Scotland financial report published in February 2008 there is no evidence of an unsustainable position. Just seven weeks later it was forced to seek £12 billion in new capital. ... On 26 February 2009, the Royal Bank of Scotland had lost £24billion, the greatest loss in British corporate history. By June 2009, British taxpayers had spent £45.5 billion to bail out the RBS and another £50 billion for a toxic assets protection scheme – and on top of that, a ludicrous £16 million payout to its disgraced former chief executive officer, (now ex-) Sir Fred Goodwin." (Gleeson-White, 2011) p197
"In April 2001, ... Fortune magazine rated Enron 'America's Most Innovative Company for the sixth consecutive year, and number one in 'Quality of Management. Seven months later, Enron filed for bankruptcy. ... By the end of the year its shares were worth just 30 cents. Enron had over-stated its profits by over US\$1 billion." (Gleeson-White, 2011) Pp196-197
"When the board of ABC Learning realized how vastly different Ernst & Young's reading of their financial situation was from Pitcher Partners they called in a neutral third party, KPMG to examine the accounts. ... KPMG could fault neither Pitcher Partners nor Ernst & Young's radically different interpretations. As it turned out, Ernst & Young's interpretation was the correct one ... Its reading of the accounts alone diagnosed 'what was ultimately a fatal condition.'...Auditors express an opinion only; they guarantee nothing. ... [However] the Pitcher Partners Brisbane firm stands by its audit of the ABC Learning." (Gleeson-White, 2011) Pp210-211
".. accountancy firms have generally failed to deliver what the public expects from them... accounting firms should be open to scrutiny. But in fact, ... accountancy firms are being granted more and more liability concessions." Prem Sikka, Prof of Accounting at Uni of Essex in (Gleeson-White, 2011) p217
"[The] 2003 HIH Royal Commission Report concluded that: 'despite [myriad governance] mechanisms the corporate officers, auditors and regulators of HIH failed to see, remedy or report ... [the] obvious.'" (Gleeson-White, 2011) p208

Accounting is a dynamic discipline that continues to change over time, according to the perceived practical needs of both accountants and policy makers. Barton

(Barton, 1975) explains that accounting is an evolving art that has for centuries developed “countless principles”:

*... to solve specific practical problems. These 'principles' are generally no more than rationalizations of current practices. ... The purpose in developing a theory of accounting is to establish standards for judging the acceptability of accounting methods. Procedures that meet the standards should be employed; those failing to meet the standards should be rejected. Pp14-15*

Barton (Barton, 1975) states that the crucial issue for accountants is to establish the “acceptability of accounting methods”. Those that do not meet the professional standards of competence required at the time should be rejected p15.

It is arguable therefore, that if the accounting methods used in the SNA are unable to accommodate the multidimensional aspects of sustainability needed for effective policy, then the existing SNAs should be rejected, or transformed. Barton’s comments justify the notion of changing the conceptual and ontological underpinnings of conventional SNA approaches towards a sustainability-informed approach, on the grounds that they fail to ‘meet the standards’ required for sustainability. As Brown and Frame (Brown and Frame, 2005) report:

*The need for dialogic and participatory 'accountings' has been recognized for at least twenty years in the accounting discipline and has a lengthy pedigree in many other disciplines. The shortcomings of monologic, technical approaches have become particularly evident with the rise of interest in [sustainable development]. p4*

There are schools of thought within the discipline that are working to make accounting more in accord with aspects of sustainability. Brown and Frame (Brown and Frame, 2005) (p3) explain that there is recognition within and outside the profession of the “... need for 'accountings' that facilitate more participatory forms of decision-making and accountability. This is particularly evident in the social and environmental accounting literature, which has long sought to take pluralism seriously”.

This suggests that the SNA can be adapted professionally to meet changing demands of sustainability accounting.

Accounting is more of a normative narrative that is generally thought. Creating a sustainability-informed accounting narrative is not significantly different from the



techniques use to assign costs and values already in use by accountants. As Miller (Miller, 1994) explains, cost accounting

*... includes a multitude of techniques for calculating costs, identifying deviations from standards, producing budgets and comparing these with the results actually attained, computing rates of return achieved on investments as well as discounted rates of return projected for the future, arriving at transfer prices for intrafirm transactions, and much else besides. p242*

The implication is that moving beyond quantification, monetisation and aggregation as the basis for accounting is not likely to undermine the conceptual foundations of the broader profession.

Recognition of the importance of learning in the sustainability policy process is growing (Tàbara and Pahl-Wostl, 2007). Froger and Zyla (Froger and Zyla, 1998) suggest that sustainability policy formulation has “...an important heuristic role, inviting a synthesis between the exigencies of continuing economic development and the need of preserving the natural environment” (p277).

The new digital technologies offer a wide range of data organisation possibilities other than mere quantification. These tools can transform accounting from being a stumbling block for sustainability to being a powerful policy tool.

The remainder of the chapter explains the existing issues with accounting and outlines common constraints that inhibit appropriate reform for sustainability policy purposes. The chapter to follow puts forward a new way to structure accounting and recalibrate activities that support and enhance sustainability perspectives.

#### **10.4 Issues with existing SNAs**

The existing SNA is not an impartial structuring of relevant data. The data are collected and organised in ways to meet the requirements of the neoclassical economic framework; economic activities that are registered in market transactions are the central focus of the accounting process<sup>94</sup>. It follows that any aspects of

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<sup>94</sup> There are aspects of the SNA that are imputed in the construction of the official accounts. However, by and large, they are attempts to provide monetary values of intangible goods, such as ‘goodwill’, etc. Such imputed values do not effect the argument being made here. “Almost 15 percent of GDP

economic activity that do not accord with the neoclassical economic *concept* of economic activity, are not counted. That is, over and above the arguments about market exclusion, conceptual exclusion can occur because of the way the neoclassical economic interpretation ascribes economic significance to activities. For instance, the notion that the environment provides free goods and services is part of the neoclassical economic conceptualisation.

This conceptual alignment of the SNA with neoclassical economic theory on the grounds of providing consistency seems reasonable if analysis remains within the neoclassical economic discourse and fulfils the needs of policy makers and policy takers. However, the imperatives for effective sustainability policy expose that all is not well in the policy world. There are serious issues needing attention that appear to be immune to amelioration by contemporary policy processes.

The non-reflexive alignment of SNA with neoclassical economics creates a conceptual indeterminacy. Because the SNA framework is intertwined in accordance with the parameters of the neoclassical economic framework, the accounting process does not provide an impartial narrative of what is happening. The existing SNA is providing data about the economic narrative according to criteria set by the economic framework that it should be accounting for. In Miller's (Miller, 1994) words, this system lacks the "particular form of objectivity that is proper to accountancy" p242. The upshot is that SNAs are providing feedback to policymakers only in terms of the existing economic episteme; there is no scope, nor perceived need, to cross-reference the official accounts with any other narrative, episteme or discourse, such as sustainability, for instance. The indeterminacy means that no impartial data related to sustainability is possible from the conventional SNA.

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(\$1,559.4 billion of \$10,480.8 billion in 2002) is imputed... The most quantitatively significant imputation is that for the rental value of owner-occupied housing. That this imputation is based on assumptions that are approximately as crude as those for, say, valuing the time spent cleaning a house at the price a cleaning service would charge, suggests that the delineation between included and excluded activities is not purely the by-product of practical considerations. One reason for making an imputation for the value of owner-occupied housing is to ensure that the accounts are invariant to trends in home ownership (which has increased significantly in the past half-century)." ABRAHAM, K. G. & MACKIE, C. (2006) A Framework for Nonmarket Accounting. *National Bureau of Economic Research, A New Architecture for the U.S. National Accounts*, 161-193. p167

The intertwining of concepts is especially problematic for sustainability because the neoclassical economic framework is inherently non-sustainable, conceptually inadequate, methodologically flawed, and inappropriate. Thus, even if it were not indeterminate, the accounting structure and outcomes would not be symbiotic with sustainability.

Awareness of the limitations of the SNA is not new. From the beginning, the accuracy and usefulness of national income measures have been questioned. In 1938 Simon Kuznets, warned of the 'limitations of GDP measures, especially the exclusion of household production and other non-market activity, as well as many of the costs of economic development' (Gleeson-White, 2011) p229<sup>95</sup>.

Some commonly acknowledged shortcomings and criticisms of SNA that I have distilled from the literature are:

- counting both goods and bads as contributors to economic welfare
- using consumption as the sole indicator of economic wellbeing
- emphasising material expansion (economic growth) as the key indicator for improved wellbeing
- omitting the contributions of unpaid workers even though they are essential to economic and social wellbeing
- ignoring the environmental, social and cultural costs of material economic expansion, and
- the ways interpretations of SNAs can be misleading<sup>96</sup>.

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<sup>95</sup> " ... The US Commerce Department refused to calculate these estimates and ... Kuznets broke his association with the department in the late 1940s" GLEESON-WHITE, J. (2011) *Double Entry: How the merchants of Venice shaped the modern world – and how their invention could make or break the planet*, Sydney, Allen & Unwin. P192.

<sup>96</sup> Hecht HECHT, J. E. E. (2012) *National Environmental Accounting: Bridging the Gap between Ecology and Economy*, Hoboken, RFF Press. provides a full and excellent and comprehensive explanation of contemporary accounting issues between environment and economy. Some of her critiques are included in the above list.

### 10.4.1 Taxonomy of existing SNA

The basic taxonomy of existing SNA is structured with categories that organise activities primarily by their source; values are mostly assigned by market price, although some are imputed. The changes proposed are to structure the taxonomy so that activities are organised by functional properties, and assigned values according to a range of sustainability-informed attributes and metaproperties.

In framing a sustainability-informed SNA, a series of questions need to be asked: what is to be assessed, how is it to be assessed (i.e. what alternatives to aggregation are conceptually available) registered or documented, how is information to be structured and organised for policy makers, business interests, government and the broader community? It is a critical issue because whoever structures the information determines what analysis can be undertaken and what indicators provided. O'Connor (O'Connor, 2002) claims that the central question for sustainability policy and decision-makers is

*... who decides the information categories and the criteria for comparison and choice? Arbitrations over survival, expansion and disappearance of different forms of life, economies, ethical and aesthetic sensibilities are "matters of life and death" for many stakeholders in sustainability policy decisions. p42*

Contemporary SNA excludes non-market goods and services (Costanza et al., 2001b). Activities without property rights are excluded because they have no conventional economic dimension, even though they affect economic wellbeing. Waring (Waring, 1988) describes some of the aspects of New Zealand life that 'count for nothing'.

Economists generally acknowledge that economic benefits are derived from aspects that are not 'owned' *per se*, and not subject to market transactions. They are excluding them because they are not measurable by market transactions<sup>97</sup>. As Gleeson-White (Gleeson-White, 2011) explains:

*Australia records the value only of environmental assets that fall within an 'asset boundary' which includes only those natural assets which have an identifiable owner who can 'derive an economic benefit from the use of that*

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<sup>97</sup> The issues involved in imputing prices using contingent valuation and surrogate pricing methodologies are discussed above.

*asset'. Within the asset boundary are subsoil assets (or mineral deposits), land, forests, water and fish stocks in open seas under the control of an economic agent (which is often the government). But it does not include the atmosphere or ecosystems that do not have an identifiable owner who benefits economically from their use. p235*

For example, although Abraham and Mackie (Abraham and Mackie, 2006) p162 acknowledge that "... neither economic production nor contributions to social welfare take place exclusively within the market's border, but extend to many nonmarket activities", they nevertheless frame environmental aspects only in terms of the services that they provide to economic growth:

*For example, researchers studying the topic of economic growth have long had to supplement data from the national accounts with external estimates of the contributions of research and development, investments in human capital, and the services of the natural environment... (Abraham and Mackie, 2006) p16*

As Gleeson-White (Gleeson-White, 2011) continues, even the ABS acknowledges:

*"This is not to suggest that these assets are of no value. On the contrary, many of them are essential to life itself. ..."* p236

#### **10.4.2 Substitutability of resources**

The economic interpretation of sustainability is dependent on the assumption of substitutability among resources, assets and factors of production. The tacit assumption is that 'goods' can offset 'bads' through substitution of one resource for another, or with monetary compensation. The implication is that quality and diversity are not relevant considerations; that degradation can be repaired by substitution or with money (See Figure 10.2). Framing analysis in terms of "human, cultural or natural" (Costanza et al., 2001b) implies that there is some sort of base element or substance – capital – that is common to all productive capacity<sup>98</sup>. Even Costanza (Costanza et al., 2001b), one of the founders of ecological economics, frames analysis using the neoclassical economic discourse in which reality consists of various forms of capital:

*[GNP] is a poor sustainability indicator since it does not fully account for the costs related to degradation of all capital forms. This is especially troublesome*

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<sup>98</sup> Once brought to mind, the similarities between this conceptualization of reality as forms of 'capital' and the concept of phlogiston encased within combustible material are hard to dispel. They are somewhat un-nerving: has there been so little cognitive development among economist philosophers?

*for human and natural capital... A welfare indicator would subtract the value of 'bads', such as unremediated adverse pollution-related health costs, or include as costs of capital replacement or maintenance the cost of offsetting adverse effects on natural capital. p266*



Figure 10.2: The absurdity of compensation-based analysis as a way of ameliorating environmental degradation. (Nicholson, 2010)

The simplistic conceptualisation of human and biological diversity can be seen to be a legacy of the alchemistic ontology that still influences neoclassical economics: that all matter is in a state of transmutation, evolving to a higher form of capital. It is a dangerous way of thinking when dealing with complex irreversible sustainability issues.

The existing SNAs do not provide a multidimensional, impartial account of activity occurring within the broad context in which sustainability issues emerge, and there is not a symbiotic narrative between economics and sustainability that creates synergies in policy processes. Stiglitz, Sen and Fitoussi (Stiglitz et al., 2009) explain that a multidimensional statistical approach is needed to complement the market-derived data; it needs to focus on human wellbeing and with

*... measures that capture sustainability. Such a system must, of necessity, be plural – because no single measure can summarize something as complex as the wellbeing of the members of society, our system of measurement must encompass a range of different measures. p12*

### 10.5 Methodological deficiencies of the SNA: monodimensionality of the QMA

Multidimensional indicators are needed for sustainability policy to provide meaningful and dynamic feedback so as to avoid misleading conclusions and ineffective adaptive responses. A monodimensional approach to sustainability is inadequate. Loorbach and Rotmans (Loorbach and Rotmans, 2006) explain that a complex systems approach encompasses the idea of policy-making processes occurring at different conceptual levels across different spatial domains. For Gasparatos, El-Haram and Horner (Gasparatos et al., 2009), the monodimensional approach of conventional SNAs is an inhibiting legacy of a reductionist approach that frames sustainability assessment monodimensionality. They explain that reductionism is limiting the efficacy of sustainability approaches because it aims to provide a suite of single-valued criteria. That is, a single

- *measurable indicator (e.g. GDP per capita);*
- *dimension (i.e. one of the economic, environmental or social dimension);*
- *scale of analysis;*
- *objective (e.g. maximisation of economic efficiency);*
- *time horizon. (Gasparatos et al., 2009) p246*

The path to a sustainability-informed framework involves avoiding monodimensional distillation of data. This is to avoid the compromising of scientific integrity that occurs when complex issues are monitored, measured, and analysed in concepts that adapt investigations to suit quantificationist methodologies.

The triad methodology of quantification-monetisation-aggregation (QMA) means that obtaining appropriate, multidimensional sustainability indicators from the conventional SNAs is not even theoretically possible. Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) report that the new understandings of

*... economies, societies and ecosystems as complex adaptive systems that cannot be fully captured through a single perspective further adds to the argument. Failure to describe these systems in a holistic manner through the synthesis of their different non-reducible and perfectly legitimate perspectives amounts to reductionism. An implication of the above is the fact that not a single sustainability metric at the moment can claim to comprehensively assess sustainability. p245*

Quantified, monetised aggregations (QMAs) are monodimensional simplifications that do not provide the depth and breadth of information necessary for effective accountability in a complex world. As Gleeson-White (Gleeson-White, 2011) reports:

*Financial statements have failed ... to reveal the true state of companies whose collapse is imminent: Enron, WorldCom, HIH and One.Tel. ... Despite the fact that accounting 'inaccuracies' go hand in hand with sudden corporate collapses and failures, accounting itself is never questioned. p215*

The problems with the quantification-monetisation-aggregation (QMA) approach are set out below.

### 10.5.1 Quantificationism

Quantificationism arises from the desire for a single metric on which to base decisions (Strauch, 1974). The sustainability-informed approach offers a set of indicators so that a variety of options can be considered for policy action, according to a range of criteria, within a precautionary, iterative, pluralistic approach. Porter (Porter, 1995) describes "trust in numbers" as the belief that numbers inherently provide a degree of objectivity that is more useful than other indicators, such as photographs or community narratives in decision making. Ackerman argues (Ackerman, 2004a) that the notion that quantified economic analysis needs to precede all policy decisions to ensure viability is a relatively new (post 1970s) phenomenon. Frame and O'Connor (Frame and O'Connor, 2011) explain that there are limits to the efficacy of quantification as a meaningful assessment tool in complex situations:

*... in making assessments across different features of complex ecosystems and socio-economic considerations, (i) the effects of alternative courses of action may indeed be comparable in a number of different ways, but this information cannot always be brought meaningfully into a single unit of measure, and (ii) even where a common unit is possible (e.g., energy flow units) this may not enable choice-informing judgments between alternatives. p2*

The challenge for sustainability policy makers is to find accounting methodologies that incorporate multidimensional qualitative indicators that are not dependent on quantification. However, the conventional approach by reformers is to augment existing approaches by applying 'objective' quantificationist techniques to the



unquantifiable and the intangible. O'Connor (O'Connor, 2002) explains the problems associated with quantification of environmental aspects for economic purposes:

*While mathematical formalism can lend an aura of quantification - and hence of a superior 'rationality' - to the evaluation procedure, these are situations where precise quantification is quite impossible. First, it is impossible to quantify all the roles played by the environment as a source of livelihood, as a place of perception and physical activity, and as a site for waste disposal. Second, long-term ecological effects of many economic decisions are non-quantifiable, and in any case will depend on actions subsequently taken, interwoven with side-effects of other past actions. Underlying disagreements on scientific, political and ethical matters may end up reframed in the arcane language of modelling, but without being resolved at all. p40*

The pitfalls of quantificationist framing of issues are not always seen. For instance, Böhringera and Jochem (Böhringera and Jochem, 2007) state that quantified and aggregable data are 'obvious pre-requisites' for a sustainability index. Yet, in the next sentence, they acknowledge that the 'normalization of data' that underpins this approach cannot be undertaken without a value judgement. The dilemma arises because researchers opt to serve an inadequate policy framework by simplifying complexity rather than demanding reconceptualisation of the policy framework and processes in order to accommodate the new realities of complexity.

***Scientifically sound methods for normalization*** (to make data 'comparable'), ***weighting*** (to specify the 'correct' interrelationships), and ***aggregation*** (to get the 'right' functional relationship) are obviously pre-requisite for the construction of meaningful [sustainability] indices. However, ... ***the normalization of data implies a value judgment***, as different scales could not be harmonized in a meaningful manner. (Böhringera and Jochem, 2007) p2 (My emphases).

The argument of this thesis is that, rather than being seen as obvious pre-requisites, normalisation and aggregation should not be undertaken when it jeopardises methodological integrity. Rather than manipulating data to suit unrealistic expectations, researchers need to develop policy learning strategies so that policy makers can be better informed.

There is a range of assessment and evaluation tools available for use by policy makers – especially with the advent of accessible digital technologies. Bressers and Rosenbaums' (Bressers and Rosenbaum, 2000) concept of 'ecological rationality' is

an example of the way in which accounts could be augmented by reframing the valuation processes, using qualitative perspectives built from cognitive and conceptual change. They describe it as:

*... an ecological sensibility that is more than a policy goal or even a value (like "preserving the integrity of the ecosystem" would be). It represents a certain way of thinking about the world with its own logic and a characteristic mode of interpreting the world. That mode includes the acknowledgment that all systems (not only natural ones) are nested in other systems, that system characteristics are more than the sum of the characteristics of the constituent parts, that system qualities evolve in sometimes unpredictable ways, and that a continuous self-regulating mutual adaptation occurs between system parts and their surroundings. p533*

### **10.5.2 Monetisation**

Monetisation is the process by which diverse attributes and properties are distilled into a single unit of account. Monetisation of data is built on the tacit presumption that money is a 'measuring rod'. There are two issues: firstly, monetisation is not an arbitrary process because the decision to monetise disparate aspects is a subjective one; and secondly, the variability of exchange rates in modern finance means that the values of money units are not constant over time. Ergo, monetisation is no longer an impartial measuring rod based on a fixed unit of account.

Significant and consistent international currency fluctuations became commonplace in the last part of the 20<sup>th</sup> century. These fluctuations impact on money's role as a unit of account: money no longer provides an impartial measurement rod. As well as the fluctuations in relative values between currencies, the causes of the fluctuations are largely the result of speculative activities. Hart (Hart, 2001) reports that less than 1% of international transactions are to do with trade. Economists manage these short-term fluctuations with techniques to create current and constant prices. However, this is an outdated approach that may be useful for speculators and financial traders who work to hedge against fluctuations, but the non-price values of environmental and other non-market goods and services do not fluctuate according to the whims of speculators. To use the monodimensional criteria of monetisation to value goods and services is to perpetuate a methodology that proceeds *as if* there were such a thing as a constant money value that underpinned prices. In the 1920s, Pigou (in (Landefeld et al.)) described money as a

‘measuring rod’. Landefeld (Landefeld et al.) cites work by Abraham and Mackie (Abraham and Mackie, 2005) who claim that

*...nonmarket household production can ‘with mild straining’ be measured indirectly with the measuring-rod of money... (His emphasis)<sup>99</sup>. p1*

Given the flexibility of exchange rates, and especially the causes of those fluctuations, it is an illusion to think that a strategy of using proxies for market prices removes normative aspects from the SNA. The fact is that electronic fund transfers and flexible exchange rates have created powerful opportunities for currency speculators to influence money prices and economic activity (Hart, 2001, Strange, 1986). Poovey (Poovey, 2003a) reports that, since 1995 the finance, banking and real estate worlds have exceeded production as income generators in the U.S. economy<sup>100</sup>. Gleeson-White (Gleeson-White, 2011) provides a practical opinion of the contemporary accounting practices:

*With the creation of the derivatives market and other financing tools in the 1980s, company accounts have become ever more opaque. ... investor Warren Buffet wrote in 2004: ‘No matter how financially sophisticated you are, you can’t possibly learn from reading the disclosure documents of a derivatives-intensive company what risks lurk in its positions. Indeed, the more you know about derivatives, the less you will feel you can learn from the disclosures normally proffered you.’ p198*

A monetary indicator does not have the capacity to account fully for ecological restoration processes. Ascribing monetary figures to environmental aspects may provide an indication of the scale of investment required to ameliorate ecological damage, but it keeps the policy analysis in an ‘as if’ conceptual framework. The functionings of ecosystems are not abstractions; life is complex and extinction is irreversible. It takes time, timing, and appropriate combinations of skills and

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<sup>99</sup> One surmises that it is up to the reader to guess what “mild straining” means; an example of the illusion of coherence generated by economists.

<sup>100</sup> “...what we have seen in the U.S. since 1995 is a change in the ratio between the wealth generated by production and the wealth created by finance: in 1995 the sector composed of finance, insurance, and real estate overtook the manufacturing sector in America’s gross domestic product. By the year 2000 this sector led manufacturing in profits. Not incidentally, in the same year this sector also became one of the biggest donors to federal elections in the U.S., and its representatives spent enormous sums of money lobbying Congress in Washington” POOVEY, M. (2003a) Can Numbers Ensure Honesty? Unrealistic Expectations and the U.S. Accounting Scandal. *Notices of the AMS*, 27-35.” P27-28

resources for remediation to happen. Money cannot extinguish all liability or obligation and it cannot restore ecological health of its own accord.

### 10.5.3 Aggregation

The legitimacy of aggregation is a powerful and deeply embedded part of the economic episteme. However, Stiglitz, Sen and Fitoussi (Stiglitz et al., 2009) explain that more than aggregated averages are needed for analysis that aims at more than material accumulation as an indicator of wellbeing:

*The issue of aggregation across dimensions (that is to say, how we add up, for example, a measure of health with a measure of consumption of conventional goods), while important, is subordinate to the establishment of a broad statistical system that captures as many of the relevant dimensions as possible. Such a system should not just measure average levels of wellbeing within a given community, and how they change over time, but also document the diversity of peoples' experiences and the linkages across various dimensions of people's life. There are several dimensions to wellbeing but a good place to start is the measurement of material wellbeing or living standards. p12*

### 10.6 Conventional reform approaches: augmenting the SNA and satellite accounts

Existing attempts at augmenting the SNA generally avoid the conceptual constraints imposed by the neoclassical economic ontology. The technical limitations – such as market failure and pricing non-market activities, externalities and intangible goods and services – are often addressed (e.g. (Hecht, 2012)), but the conceptual underpinnings such as the framing analysis with economic interpretations of reality, such as natural, human or social capital, still remain as the mainstay of policy approaches. The rationales proposed by Landefeld et al. (Landefeld et al.) are that consistency among and between accounts is paramount, that inclusion of non-market intangible aspects of economic activity would over-burden the SNA, and that keeping non-market in satellite accounts keeps normative aspects separate from the SNA.

The efforts for reform have focused on creation of satellite accounts, and resulted in numerous and diverse indicators of welfare, such as wellbeing, environmental health, state of the environment reporting, happiness index, liveability, etc. The United Nations describes the role of satellite accounts as providing:

*... a framework linked to the central accounts and which enables attention to be focused on a certain field or aspect of economic and social life in the context of national accounts; common examples are satellite accounts for the environment, or tourism, or unpaid household work. (Abraham and Mackie, 2006) p169*

Satellite accounts are regarded as adjuncts to the mainstream SNA. International guidelines suggest that satellite accounts are appropriate for non-market accounting (Landefeld et al.). That is rather than expand the existing SNA the qualitative non-market aspects needed for sustainability need to be kept marginalised as supplementary accounts so as to not burden or affect the usefulness of the core accounts. The shortcomings of the 'core' SNA are ignored.

The conceptual underpinnings of neoclassical economics are not challenged in the construction of satellite accounts; instead augmentation is approached using quantification, monetisation and aggregation (QMA) techniques. As a result, the satellite accounts remain within the confines of the neoclassical economic discourse and end up traversing old ground and providing depressing information about how bad things are getting. No satellite accounts have had a policy impact that is commensurate with the quality of information they provide. The urgency of the imperatives has met with procrastination and endless seminars about the problems with the structure of the national accounts. Satellite accounts continue to be regarded as "experimental" attempts to provide "data on activities not covered – or not adequately covered" in conventional accounts (Abraham and Mackie, 2006) p168. They remain on the margins of mainstream policy, permitted to "exist alongside", but not to challenge the "core accounts":

*The core accounts have the virtues of consistency over time, hard-won comparability across countries, and solid grounding in observed market transactions. These are strong arguments for maintaining the core accounts in more or less their current form. (Abraham and Mackie, 2006) Pp164-165*

The perception that the 'core accounts' are adequate is justified only if sustainability issues are subordinated to economic interpretations. Any augmentations provided by the satellite accounts are discounted if the satellite data conflict with the core accounts. The official UN perspective is that they are of

interest, and tolerated, so long as they do not overburden or disrupt the central system of national accounts (Abraham and Mackie, 2006) p169.

There is no accounting for many aspects of sustainability issues in conventional accounts and no scope to include unintended consequences of economic activities, externalities, resource depletion, human health and wellbeing, except insofar as it involves a recordable market transaction. The trap to which satellite accountants succumb is to attempt to apply QMA processes to these aspects of sustainability so that they will 'fit' into the SNA. Hence the emphasis in SNA research on attempting to assign price values to environmental assets, social capital, human capital, etc, or differentiating between whether consumption or production are better indicators of wellbeing<sup>101</sup>. The satellite accounts approach is to frame 'alternative concepts, classifications and measurement techniques' (Gleeson-White, 2011) (p234) in money prices derived from surrogate pricing or contingent valuation techniques.

The methodologies and techniques that are used to put money prices on environmental aspects are contested. The ABS describes them as "... arbitrary and controversial." (in (Gleeson-White, 2011) p236). Ackerman and Heinzerling (Ackerman and Heinzerling, 2004) cite a cost benefit analysis done in 2002 by the United States Office of Management and Budget (OMB) which

*... announced that the new forest initiative would cost about \$184 million and produce benefits of only \$219,000 a year... This lopsidedly negative result made forest protection look, in narrow economic terms, like one of the least defensible regulatory ideas of the previous year. ... How did a rule protecting 60 million acres of publicly owned lands, containing fragile and precious sources of water, wildlife, and plant species, come to look so bad in economic terms? ... What did the tiny annual benefit of \$219,000 reflect in this case? The savings from not building roads [through the park]. p7*

Non-measurable aspects relevant to sustainability policy may be recognised, but ignored from policy considerations. The Australian Bureau of Statistics (Australian

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<sup>101</sup> For example, Abraham writes: "There is wide agreement ... that the output of the education sector properly should be considered investment rather than consumption, and that its value should be assessed in terms of the returns on that investment rather than the cost of the inputs used in its production. The conventional accounts do not include the asset value of human capital production associated with education, health care and other personal investment activities." ABRAHAM, K. G. & MACKIE, C. (2006) A Framework for Nonmarket Accounting. *National Bureau of Economic Research, A New Architecture for the U.S. National Accounts*, 161-193. p161-162

Bureau of Statistics, 2009) acknowledges that non-measurable economic activities remain unmanaged because they are not measurable:

*There are well-known deficiencies in both the economic and environmental information systems. At present, the links between socioeconomic and environmental issues are poorly acknowledged, expressed and measured. It is also well known that those things that defy measurement often go unmanaged. p9*

This is a telling statement because a critical aspect of the broader sustainability concept – the relationship “... between socioeconomic and environmental issues” – is acknowledged by the ABS (Australian Bureau of Statistics, 2009) p9. To knowingly leave these issues unmanaged, “... poorly acknowledged, [and] expressed ...” merely because they “... defy measurement ...” (Australian Bureau of Statistics, 2009) (p9) is to perpetuate ineffective policy because adaptation of institutional structures and professional expertise to accommodate sustainability remains outside the square in which their thinking is contained. Rather than reassess and reconceptualise the framework by which items are accounted, the ABS expects that these non-measurable aspects will continue to be ignored in the foreseeable future:

*... ‘work on the valuation of environmental damage (externalities associated with human and economic activity) is an undeveloped field of research and it is unlikely that the ABS will have the capacity to make advances in this area in the foreseeable future’. in (Gleeson-White, 2011) p236*

Thus, change for sustainability is not the result of an information deficit. Although the shortcomings of the conventional SNA are well known, the existing SNA, with its comfortable relationship with neoclassical economics, remains the dominant indicator for economic and other public policy, such as sustainability.

Böhringera and Jochem (Böhringera and Jochem, 2007) surveyed eleven sustainability indices as to their consistency and meaningfulness:

*... the Living Planet Index (LPI), Ecological Footprint (EF), City Development Index (CDI), Human Development Index (HDI), Environmental Sustainability Index (ESI), Environmental Performance Index (EPI), Environmental Vulnerability Index (EVI), Index of Sustainable Economic Welfare/Genuine Progress Index (ISEW/GPI), wellbeing Index (WI), Genuine Savings Index (GS), and Environmental Adjusted Domestic Product (EDP). Pp3-5*

They found none of these indicators were useable; commensuration and aggregation issues resulted in all the indicators failing to fulfil fundamental scientific

requirements, 'making them rather useless if not misleading with respect to policy advice' (Böhringera and Jochem, 2007) p1<sup>102</sup>. That is, the augmentation that occurring is ineffective because it is framed within the neoclassical economic discourse, involving no methodological or conceptual changes in the accounting process to include qualitative aspects needed by sustainability.

Some argue that the current system needs to be persevered with because it is in common use. However this is not a valid justification for perpetuating the use of an inadequate approach, in the context of the urgency and significance of the imperatives for effective sustainability policy. It is tantamount to arguing that the Theory of Phlogiston (Conant, 1967) should not have been challenged because it had been taught in all the universities for almost a century and it was commensurable with the Aristotelean paradigm that had been the basis of science for two millennia. The fact is, awareness of complexity and sustainability issues now exists, awareness of the inadequacy of existing SNA exists, but the impetus to change is thwarted because of the dominance and self-referentialism of neoclassical economics in the policy processes.

### **10.7 Conclusion**

This chapter has exposed the co-dependence of SNAs with the neoclassical economic episteme and challenged the inviolability and usefulness of the contemporary SNA approach as a framework for sustainability policy.

The conventional system of national accounts is framed by, and related to, the neoclassical economic paradigm: cognitively, conceptually and ontologically. Thus the national accounting indicators are derived from the neoclassical economic interpretation of sustainability. The conventional SNA does not provide impartial accounts of economic policy because the accounts are framed in ways to accord with the self-referential neoclassical economic framework.

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102 "There are three central issues to be addressed. Firstly, in selecting input variables one should be conscious that themes determine the thematic aggregation method and units determine the technical aggregation method. Secondly, as there are no general rules for normalization of these variables and their weighting these procedures should be treated in a transparent way with great reserve and be subject to comprehensive sensitivity analysis. Thirdly, commensurability of input variables should be assured." BOHRINGERA, C. & JOCHEM, P. E. P. (2007) Measuring the immeasurable — A survey of sustainability indices. *Ecological Economics*, 63, 1-8. P2



A sustainability-informed system of national accounts involves countervailing the neoclassical economic dominance of the SNA framework (by reframing economics within a sustainability-informed policy framework).

By reconceptualising certain aspects of the SNA within a sustainability-informed ontological framework, the possibility of a hitherto under-utilised option for change emerges. A sustainability-informed SNA (SISNA) can be created that would help create a symbiosis between sustainability and economics – and thus facilitate effective sustainability policy. It is conceivable that a sustainability-informed ontology can link to a multidimensional accounting narrative and be organised into a taxonomy that provides appropriate information, capacity for adaptation and iterative decisions, as well as learning experiences that are necessary for sustainability policymakers and the broader community of users. As Ackerman and Heinzerling suggest, the changes needed are to do with attitude, not algorithm (Ackerman and Heinzerling, 2004) p7.

The emphasis on accounting as a narrative, rather than merely ‘counting’, creates capacity to apply strategic considerations that encompass all the layers in which sustainability policy issues manifest.

The change process suggested is cognitive, conceptual and ontological, not ideological. A basic premise is that sustainability accounting needs to be commensurable with contemporary scientific understandings and methodologies if it is to provide adequate information for the unprecedented complex issues now confronting policymakers.

The next chapter describes some issues and approaches that may be incorporated in adapting existing aspects of the ATO BIC to move towards a Sustainability-Informed System of National Accounts (SISNA).

## Chapter 11: Conceptual underpinnings of a sustainability-informed system of national accounts

### 11.1 Introduction

At present, the Australian system of national accounts does not provide information appropriate to, or necessary for, effective sustainability policy. It is framed by the neoclassical economic discourse and geared to the needs of the neoclassical economic policy processes. Landefeld (Landefeld, 2000) inadvertently explains a crucial flaw in the epistemological underpinnings of the existing system of national accounts (SNA) in relation to sustainability:

*... These [national accounts] benchmark estimates provide a detailed and rich picture of the economy, reflecting **the most recent methodologies used to organize the underlying data to fit with the economic theory embodied in the national accounts.** (My emphasis)*

That is, the current SNA is geared *to fit with* economic theory; it is not geared to provide an impartial perspective of the *efficacy* of economic policy by other multidimensional criteria. On one level this can be seen as a valid attempt to ensure compatibility across data and methods. However, on another level it means that there is no impartial or independent paradigm to incorporate qualitative, non-economic data in the national indicators. The system of national accounts is framed to align with the neoclassical economic paradigm, and the neoclassical economic framework uses the system of national accounts to validate its policy initiatives in a self-reinforcing cycle.

This is an important issue because the neoclassical economic framework to which the SNA is aligned is non-sustainable. The collection and presentation of data in the SNA have no compatibility with sustainability criteria outside the neoclassical economic interpretation of sustainability. Thus the existing SNA is part of the self-referentialism of the neoclassical economic discourse that inhibits movement towards sustainability. *Reform* of economics in favour of sustainability is not enough to overcome the schism. The necessary changes need to be brought about by reconceptualisation of the SNA so that it has a degree of independence of the economics discipline. Change processes can be heuristic employing “mental

strategies” to address issues (Piattelli-Palmarini, 1994). The premise here is that the conceptual basis of the existing SNA is a latent change point.

Focusing on the accounting narrative as the vehicle to bring about changes necessary for effective sustainability policy is bold but necessary. As Gleeson-White (Gleeson-White, 2011) explains:

*For better or worse, accounting is our way of measuring the way we use all the precious resources of this planet, human, natural and synthetic. Accounting is fundamental to the functioning and development of twenty-first century societies. And the way we measure our resources – or don't measure them– determines how we value the earth and consequently influences the way behave. p252*

In this chapter I aim to explain how a SISNA could be developed by reframing, reconceptualising and restructuring the existing approach to national accounting into a sustainability-informed structure – described herein – that is constructed and formatted within a relational database. Accounting needs to be seen as a narrative, and moved beyond counting and aggregation. Such a move is possible because of the new modes of documentation that have been developed in the 20<sup>th</sup> and early 21<sup>st</sup> century. These processes include satellite digital imaging, internet search engines, digital internet mapping, GPS locators, smart phones, and database technologies that were not in existence or conceivable or available when the current system of national accounts was devised.

The existing system of Australian Taxation Office Business Industry Codes (ATO BIC) (Australian Government Taxation Office, 2005) is used as a starting point. The chapter explains how it does not meet sustainability accounting requirements in its current form, but that it could be adapted to bring it into accord with the needs of a sustainability-informed system of national accounts.

In this chapter I explain how a workable SISNA could be derived from a multidimensional accounting process. It involves recalibrating and re-organising economic activities in a sustainability-informed taxonomy based on functions, attributes, metaproperties that are symbiotic with sustainability, not conflictual. The aim is to explain how this creates the opportunity for the accounting narrative

to provide more diverse and richer information for individual businesses as well as sustainability policy makers.

### **11.2 The existing approach: the Australian Tax Office (ATO) List of Business Industry Codes (BIC)**

The ATO BIC is currently organised into a feature-list taxonomy (Andersen et al., 2006) consisting of 2722 descriptions of business activity. These are organised into 19 genres or major headings, representing 86 types of activity. These 86 types of activity are broken into 198 categories from which 567 sub categories are used to organise the 2722 activity descriptors of industry/business types that reflect the activity being undertaken (See Table 11.1).

In the existing ATO BIC approach, the existing attributes and metaproperties in the lead categories are framed with source-based criteria that explain where the activity came from – primary, secondary, tertiary. A knowledge of where activities came from only partly meets the needs of sustainability policy: information about energy efficiency, renewability, and other functional properties of economic activities are needed.

However, the fact that the ATO BIC taxonomy exists at all means that there is a starting point from which a SISNA can be developed.

<b>Table 11.1 Summary of ATO Business Industry Codes 2009</b>					
(Australian Government Taxation Office, 2005)					
<b>ATO Code Range</b>	<b>Sector</b>	<b>Types</b>	<b>Categories</b>	<b>Sub Categories</b>	<b>Descriptors</b>
01110 - 05290	1. AGRICULTURE, FORESTRY AND FISHING	5	15	52	200
06000 - 10900	2. MINING	5	7	21	51
11110 - 25990	3. MANUFACTURING	15	39	142	847
26110 - 29220	4. ELECTRICITY, GAS, WATER and WASTE SERVICES	4	8	13	26
30110 - 32990	5. CONSTRUCTION	3	8	25	164
33110 - 38000	6. WHOLESALE TRADE	6	11	41	256
39110 - 43202	7. RETAIL TRADE	5	14	51	248
44000 - 45302	8. ACCOMMODATION AND FOOD SERVICES	2	4	7	34
46100 - 53090	9. TRANSPORT POSTAL AND WAREHOUSING	8	14	26	115
54110 - 60200	10. MEDIA AND TELECOMMUNICATIONS	7	12	23	60
62100 - 64200	11. FINANCIAL AND INSURANCE SERVICES	3	9	14	56
66110 - 67200	12. RENTAL, HIRING AND REAL ESTATE SERVICES	2	6	10	61
69100 - 70000	13. PROFESSIONAL, SCIENTIFIC & TECHNICAL SERVICES	2	9	18	128
72110 - 73200	14. ADMINISTRATIVE AND SUPPORT SERVICES	2	5	12	48
75100 - 77200	15. PUBLIC ADMINISTRATION AND SAFETY	3	8	13	31
80100 - 82200	16. EDUCATION AND TRAINING	3	5	13	68
84010 - 87900	17. HEALTHCARE AND SOCIAL ASSISTANCE	4	8	26	110
89100 - 92099	18. ARTS AND RECREATION SERVICES	4	7	29	100
94110 - 94129	19. OTHER SERVICES	3	9	31	119
<b>TOTALS</b>	<b>19</b>	<b>86</b>	<b>198</b>	<b>567</b>	<b>2722</b>

There are two significant issues that need to be discussed because, as it stands, the ATO BIC list is not a taxonomy that provides appropriate information for sustainability policy:

1. The categories are organised as a feature-list, rather than as a dynamically framed, nested hierarchy of activities (described above). Consequently, the scope for augmenting the data with qualitative data, or providing scope for cognitive or conceptual change for sustainability is small.
2. The categories are organised by a diverse range of criteria that appear to have no overarching integrity or relationality.

The feature list approach suits a QMA-oriented approach to accounting. Income earned from activities is aggregated. However, analysis of the sub-categories – i.e. what groups the activities are organised into – provides no information about the overall sustainability aspects of the activities within those sub-categories. That is, neither the aggregates nor the sub-totals actually provide information about

resource use, energy efficiency, environmental impact, benefits to wellbeing, or any other aspect of sustainability.

The categories of ATO feature-list are defined by criteria with little consistency. The attributes and metaproperties used to categorise activities are not integrated; there is no apparent procedural unity in devising separate categories. For instance, manufacture of wigs is in the generic sub-category “Other manufacturing” – sub category 25990 (Table 11.2) – which also includes umbrella manufacturing, musical instrument manufacturing, pencil manufacturing, pen manufacturing, and stamp pads manufacturing. The sub-category also includes brooms and brushes, hairbrushes, paintbrushes, toothbrushes as separate line items but sharing the same identity with all the other items mentioned. This brushes group may be included because they all relate to hair of one sort or another, but the links between brushes and musical instruments and pencils and pens are tenuous. The grouping of items provides little qualitative or quantitative information about the activities described therein: there are 10 diverse activities grouped in the one sub-category. The only data coming out are the aggregation of incomes earned across all of those activities. This is not helpful for sustainability policy, and possibly a missed data opportunity for conventional policy makers.

For example, if manufacturing of musical instruments should suddenly increase – for instance if there were a ukulele craze – there would be no way of finding out the significance of this from the ATO BIC groupings. The ATO BIC groupings could not differentiate between a surge in musical instrument manufacture and a surge in manufacturing of wigs. This may be relevant because ukulele playing has social, cultural and economic impacts, and, in terms of timber required, ecological impacts<sup>103</sup>.

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<sup>103</sup> *Acacia melanoxylon*, or Tasmanian blackwood is an excellent wood for making ukuleles and other musical instruments.

**Table 11.2 Australian Tax Office Business Industry Codes (ATO BIC) Sub category 25990 with 10 descriptors grouped by miscellaneous criteria (Australian Government Taxation Office, 2005)**

25990	Brooms and brushes mfg
25990	Hair brushes mfg
25990	Musical instrument mfg
25990	Paint brushes mfg
25990	Pencils mfg
25990	Pens mfg
25990	Stamp pads mfg
25990	Toothbrushes mfg
25990	Umbrellas mfg
25990	Wigs mfg

Furthermore, the scale of differentiation between items in categories is inconsistent. For instance, the ATO draws a distinction between activities ‘Snake farming’ (sub category 01990) (Table 11.3) and ‘Snake catching’ (sub category 04200). However, snake farming is grouped with butterfly farming and cat breeding in sub category 01990, while snake catching is grouped with trapping and hunting of a diverse range of wild native and feral animals. The groupings in 01990 are by forms of husbandry (farming), the second by the means of catching the animal (hunting and trapping). While there is butterfly farming in 01990, there is no butterfly catching in 04200. Perhaps there is no such business.

The separation of these activities into groupings described by husbandry versus hunting and trapping provides little information about ecological or economic or social or cultural aspects of these activities. The diversity within groupings mean that the sub totals of the sub-categories or ‘groupings’ are too general to provide data useful for policy. If for instance, there is a surge of income from category 01990, it would not be possible to tell if it were because of increases or improvements in goat husbandry, rabbit breeding, butterflies, snakes or cats. From a sustainability policy perspective, there are significantly different cultural and ecological implications of rabbit hunting compared to kangaroo hunting. Aggregating the items in this sub-category or ‘grouping’ is not helpful for sustainability policy purposes.

**Table 11.3 ATO BIC Sub categories 01990 with 12 descriptors grouped by husbandry and sub-category 04200 with 10 descriptors grouped by catching method**  
(Australian Government Taxation Office, 2005)

01990	Agistment service (goat)	04200	Bird trapping
01990	Bird breeding – except poultry or game birds	04200	Buffalo hunting
01990	Butterfly breeding	04200	Crocodile hunting
01990	Cat breeding	04200	Dingo hunting or trapping
01990	Crocodile farming	04200	Fur skin animal hunting or trapping
01990	Dog breeding	04200	<i>Hunting or trapping</i>
01990	Fur skin animals farming	04200	Kangaroo hunting
01990	Goat farming	04200	Possum hunting and trapping
01990	Livestock raising nec	04200	Rabbit hunting or trapping
01990	Pet breeding	04200	<i>Snake catching</i>
01990	Rabbit farming		
01990	<i>Snake farming</i>		

One wonders why sub-category or ‘grouping’ 04200 has 10 descriptors when one of those descriptors is the generic “Hunting or trapping”, which would include all the other activities grouped. There are many other anomalies.

Table 11.4 provides examples from the ATO BIC of the range of attributes or metaproperties used to differentiate between categories, sub-categories or descriptors of activity.

**Table 11.4 ATO BIC examples of criteria used to describe attributes and metaproperties**  
(Australian Government Taxation Office, 2005)

Activity/Product Attribute Descriptor Type	Descriptor Example
Source and market function	Agricultural product wholesaling
By resource access	farm animal leasing
Material type, use and market function	timber and hardware goods; wholesaling
Activity in market	wholesale/retail
Activity Task Process	installation
Activity Task scale	heavy engineering
Product functionality	pump
Activity Contribution to Production Process	Support
Location where product used/takes place	domestic
Market Aspects of Product: niche	specialist
Activity/Product Category qualified by Exclusions	except irrigation..
Groupings by product type and market function	grocery, liquor and tobacco product wholesaling
Product Materials: What products are made from	textiles
End use of products	pharmaceutical and toiletry goods
How activity remuneration is determined	commission-based wholesaling
Business unit/structure by which goods by type are marketed	Supermarket and grocery stores
Service type delivery mode and client type	Road freight transport; Road passenger transport
Technology type used to provide service	Road freight, rail freight transport, monorail
Service provided by institution type or institutional structure from which service is provided	central, state local govt; preschool education



In some headings, businesses are organised by source of economic activity, in others by structure of the organisation in which the activity occurs. Others are categorised by a description of the activity itself, and others by the economic function being performed.

Table 11.5 shows the activities grouped in sub category 69100: Scientific Research Services. Once again the activities that are aggregated in the sub-category provide no information to policy makers as to how the firms within the science research sector are faring relatively. A surge in activity in 69100 may be due to engineering, medical or natural science research, or one of the other categories, or all of the above. It is interesting to note that 'economist' is not differentiated in the ATO codes as a separate profession, but lumped within the 11 descriptors grouped in the sub category 69100 'Scientific research services'. Economics is sub-grouped in the descriptor 'Social sciences – economics, psychology, sociology research activities'. That is, the ATO list draws no distinction between the social science professions – economics, psychology, and sociology research activities. Moreover, the 69100 sub-category also includes 'Observatory operation – except university'. Certainly they are all scientific research services, but the breadth, context and contribution of each of the areas are very different; it is difficult to see what is the common link in the category. It is interesting to surmise as to the commonality between economic research and observatory operation (except university) and what quality of information for policy and other purposes arises from aggregating these activities together.

69100	Agricultural research activities
69100	Engineering research activities
69100	Food research institution operation – except university
69100	Industrial research institution operation – except university
69100	Medical research institution operation – except university
69100	Medical science research activities
69100	Natural sciences – astronomy, chemistry, mathematics, physics, earth sciences research activities
69100	<i>Observatory operation – except university</i>
69100	Social sciences – economics, psychology, sociology research activities
69100	Scientific research institution operation – except university
69100	Technology research activities

The use of the ATO BIC as a sustainability policy tool is diminished because the criteria used to create categories are not integrated into an overarching conceptual or ontological framework. That is, they do not fulfil the identity and unity functions as described by Welty and Guarina (Welty and Guarino, 2001) above. The point is, given that this list exists, why not reconceptualise and restructure it so that it can provide useful information for sustainability policy?

### **11.3 ATO BIC as a starting point for SISNA**

The inconsistent categorisations of the existing ATO BIC provide few data for informed decision making for sustainability, and the feature list structure provides little scope for learning in an iterative policy process as required by sustainability.

The lumping of disparate line items within the same categories provides generalised aggregated data which removes the capacity to effectively analyse the changes in the economic activity at a micro level – both quantitatively and qualitatively – that is now possible with digital computer technology.

On the other hand, the fact that ATO BIC actually exists provides a starting point for the sustainability-informed system of national accounts (SISNA) process to begin. That is, the ATO BIC provides untapped potential for moving toward sustainability: it could be reframed, reconceptualised and restructured within a sustainability-informed ontology; it could be populated with data about activities that is

augmented and recalibrated according to a sustainability-informed taxonomy of attributes and metaproperties, and organised within an appropriate set of reconceptualised, sustainability-informed categories that reflect the relational ontology approach that characterises sustainability issues. The feature-list approach could be restructured according to Barsalou's principles of dynamic framing, using graded conceptualisations of activities within a nested hierarchy. This would provide the scope for ongoing learning and conceptual and cognitive development necessary to accommodate the dynamic nature of sustainability and complex issues. As Andersen, Parker and Chen (Andersen et al., 2006) suggest, a change-oriented taxonomy

*... needs to be conceptualised so that it provides scope for learning, iterative decision-making, adaptive management and development of a robust multidimensional sustainability narrative. Pp46-47*

#### **11.4 Conceptualising the SISNA: the sustainability-informed taxonomy**

Under the proposed SISNA, four categories are developed and applied to classify economic activity. These are:

##### **11.4.1 Functional properties**

The functional property of an activity relates to its role in, and impact on society. It is a conceptual change designed to reframe activities recorded in the accounting narrative from being source-based (i.e., primary, secondary and tertiary) to being function-based (i.e. generative, facilitative, distributive, extractive, and speculative). A sustainability-informed ontology is used to categorise activities. The preliminary suggested categories used to describe activities are

- 1) Generative: generating economic wellbeing and creating sustainable value.

This would include cultivation that uses methods that maintain the fertility of the soil, such as organic or biodynamic farming; the arts that foster community cohesion, reflection, reflexivity and enjoyment; construction that uses recycled materials and uses construction methods that allow materials to be re-used at a later date.

- 2) **Facilitative:** facilitating the broader level of activity in the community. This would include services and industries that enable individual growth within a vibrant, peaceful community, such as doctors, nurses, teachers and others currently described as tertiary occupations. It would also include merchants and retailers.
- 3) **Distributive:** serving distributive functions by which goods and services are provided across the community. This would include retail and wholesale merchants and distributors, as well as businesses that are created to ensure social equity, justice and harmony – such as not-for-profit enterprises which actively support creative initiatives for independent livelihoods among less well-off members of society.
- 4) **Extractive:** extracting non-renewable resources. This would encompass activities that harvest or extract resources – gifts of nature – without regard to the environmental limits, impacts or the use to which the resources are to be put; that is, no vertically integrated sustainability dimension to their activities; no life-cycle management of resource use, or closing of substance cycles.
- 5) **Speculative:** creating purchasing power by speculative manipulations within the finance and monetary sectors. This category includes activities that manipulate economic abstractions – such as derivatives – to create further abstract economic wealth; gambling, speculation and extracting wealth through luck without effort are some of the characteristics of such activities. The argument is not that such activities should be banned, but rather that sustainability policy should be able to differentiate the nature and quality of the contribution they are making to economic activity. The importance of distinguishing the validity of purchasing power for efficient market operation is discussed above.

The reframing of activities according to sustainability functional properties provides the basis for tax brackets to be used that reflect sustainability aspects of the economic activity. Currently taxation brackets are based on quantity of income

earned. The sustainability-informed accounts would enable these taxation brackets to be modified according to qualitative sustainability credentials, as accounted in the SISNA framework. Categories 1 to 5 above represent decreasing sustainability value, therefore subject to an increasing taxation rate. (The differential between brackets would not necessarily be constant: that is, the difference between facilitative and generative would not be the same as between distributive and extractive.)

For an individual firm, a higher level of sustainability results in a lower tax rate: that is, for instance, generative activities are taxed at a lower tax rate than speculative activities<sup>104</sup>. The sustainability-adjusted tax structure would provide incentives for enterprises to adapt their activities to align with sustainability goals because sustainable businesses would pay less tax. Moreover, the SISNA would be able to recognise sustainable businesses because of the qualitative data incorporated in the accounting narrative. Entrepreneurs would engage sustainability consultants to help them reduce taxation. Researchers would continue to develop sustainability monitoring regimes and evaluation processes to suit individual businesses. The sustainability-informed accounting narrative would remove the perception that sustainability is an economic cost.

#### **11.4.2 Attributes**

An attribute qualifies the existing descriptions of business or occupation (such as woodworker, teacher or engineer). Attributes describe the activity that actually occurs. They provide conceptual links to existing ATO categories and economic terminology: manufacturing, retailing, maintenance, agriculture, etc. but also provide scope to include non-market aspects of the activity – such as rehabilitation of farmland.

#### **11.4.3 Metaproperties**

Metaproperties are indicators or referents of sustainability and can be social, cultural or biophysical. Metaproperties could be derived from existing quantitative

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<sup>104</sup> The importance of being able to distinguish the origins of purchasing power for sustainability policy was discussed earlier.

and qualitative assessments that document inputs and outputs that affect sustainability such as energy use and efficiency, recyclability, use of renewable energy, water use and efficiency, or use of non-renewable resources.

Metaproperties could also relate to the application of management tools such as whole of life-cycle analysis, sustainability assessment (Brown and Frame, 2005), or an EMS 14001 approach augmented to encompass a full range of sustainability aspects.

Lowe (Lowe, 2009) points out that different types of economic activity have different environmental impacts and cites mining and grazing marginal land as high impact industries compared to writing computer software or selling information services (p76). Two issues emerge from this perspective: firstly, the existing price-based accounting processes are unable to distinguish between low and high impact industries – because accounting is monodimensional – but also there is not the ability to distinguish impacts of different firms within an industry, or between the end-of-pipeline impacts (such as carbon emissions) with the up-stream impacts created by the institutions that financed the carbon emitting businesses (Richardson, 2006).

Sustainability-informed accounting needs the capacity to apply a range of metaproperties to industries, and firms within those industries, so that these differentiations can be made and sustainability-informed economic actions encouraged.

For example, two mining companies may have different metaproperties because of their managerial approaches. Both would be categorised as extractive industries under ‘functional properties’. However, one mining company may simply extract resources and leave when the ore is gone, paying no attention to sustainability issues. In this case, the third set of digits would all register low, or zero. On the other hand, another mining company may have revegetation strategies in place, utilise energy efficient machinery and water efficient processes, resource recycling strategy so that the end-use of the ore has a planned reusability, or have training programs for employees for when the extractive phase ends and the company shifts

its emphasis to recycling previously extracted minerals. It may have a company health scheme, childcare support and sponsor local arts and community events. That is, it operates the business within a broad sustainability framework. This firm would have high ratings in these digits to represent these activities and from which they could make their case for sustainability-based tax rates.

The SISNA approach will allow businesses and policymakers to strategically employ or adapt appropriate sustainability management assessment approaches in order to guide improvement to the sustainability ratings. These may include

- Environmental Management Systems such as ISO14001 (Edwards, 2004, Martin, 1998, Schoffman et al., 2000, Whitelaw, 2004)
- strategic environmental assessment (Dovers and Marsden, 2002)
- adaptive management (Holling, 1978, Norton, 2005, Rammel and van den Bergh, 2003, Sendzimir et al., 2006, van der Brugge and van Raak, 2007)
- uncertainty management (Asselt et al., 1995, Dovers et al., 2001a, Janicke and Jorgens, 2000)
- options assessment (O'Brien, 2000, O'Connor, 2002)
- accounting: the sustainability assessment model (SAM)(Brown and Frame, 2005)

These business data could be extracted from SISNA and used to map regional, state or national progress towards sustainability. The data could be used to inform indicators such as:

*... the Living Planet Index (LPI), Ecological Footprint (EF), City Development Index (CDI), Human Development Index (HDI), Environmental Sustainability Index (ESI), Environmental Performance Index (EPI), Environmental Vulnerability Index (EVI), Index of Sustainable Economic Welfare/Genuine Progress Index (ISEW/GPI), wellbeing Index (WI), Genuine Savings Index (GS), and Environmental Adjusted Domestic Product (EDP). (Böhringer and Jochem, 2007) Pp3-5*

These indicators and assessments would then inform macro policy.

#### **11.4.4 Metatags**

A system of digits would be used as signifiers, or metatags, to code the functional properties, attributes and metaproperties. This would build on the existing 5 digit ATO system, to characterise each activity by a coding system that is likened to the structure of the IP address code used to identify computers connected to the internet. This is detailed below.

Currently each descriptor of activity in the ATO list is a 5 digit number. In the first instance, each line item would add a decimal point (e.g. .004) so that each existing descriptor could be identified with a unique code.

Secondly, a set of signifying numbers would be ascribed to each activity to represent its attributes and metaproperties. The signifying numbers would be formatted in much the same way as Internet Protocol (IP) addresses are organised to identify computers accessing the internet. These generally take the form of sets of digits separated by periods (full stops). For example, my computer DNS server addresses are 208.67.222.222 or 208.77.220.220. This system works by using number digits as signifiers rather than as quantifiers. (That is, the second address is merely different from the first one, not a multiple of ten higher.) The digits would signify particular aspects of sustainability, described by attributes and metaproperties derived from a sustainability-informed ontology – such as a complex adaptive systems perspective of issues. The numbers within each numerical ‘paragraph’ would consist of metatags that refer to attributes and metaproperties of the activity.

Thirdly, the attributes and metaproperties of economic activities are assigned metatags so they can be incorporated in summary form into the SISNA. The metatags would be linked to the relational database, so that a particular numerical signifier could call up data related to the specific sustainability properties of the business. The development of the complete system of attributes and metaproperties is a task for future research, but it is hoped the seed of the conceptual foundations are laid here.



A relational database (see below) could also incorporate algorithms therein to provide analytical assistance and indicators at the macro level in ways that were inconceivable when mathematics and economics first met in the 19<sup>th</sup> century<sup>105</sup>.

For example:

- In the proposed approach, the first five digits – also described as a paragraph - are the existing ATO descriptors, except each line item is given a unique identification code as per the requirements of a database approach. This could be achieved by appending decimal places to the line items. So category 69100 would remain as ‘Sciences research services’, but items within that category would have decimal markers: 69100.001 would be Agricultural research activities, 69100.002 would be Engineering research services, through to 69100.011 for Technological research services. In the current ATO BIC, the manufacturing category has the most line items (847), so three decimal places should be adequate. If more are needed, four decimal places could be allocated to each category. With each line item assigned a unique code, the transferral of existing categories to a database is via a simple export and import of fields.
- The second set (paragraph) of digits describes the attributes of the activity, that is, the occupation or business. The categories from which these categories are derived are related to Viability Analysis model proposed earlier consisting of two domains, the interface, and four the layers of sustainability. The first digit of the second paragraph could indicate the functional properties of the activity: whether the activity is generative (value adding), facilitative (system enhancing), distributive (system stabilising), extractive (resource depleting), or speculative (system exploiting). The second digit refers to the sustainability domain in which the activity occurs (biophysical

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<sup>105</sup> I find it helpful to draw an analogy with graphic compression formats, such as jpeg, in which certain individual pixels contain an algorithm that describes the colour attributes of the pixels in the surrounding area.

or abstract). The third digit could indicate the layer in which the activity primarily exists: ecological, cultural, social, and economic. The fourth digit refers to the nature of the interface between the biophysical domains.

- The third set (paragraph) of digits relates to the metaproperties that describe the activities in terms of sustainability indexes such as: energy efficiency, water efficiency, integrated closed substance cycles, employee and employer well-being, Indigenous engagement and involvement<sup>106</sup>. These digits provide the SISNA with qualitative data about the sustainability aspects of business. A zero rating in these categories would indicate no sustainability practice, whereas a 9 would indicate the highest level of sustainability. A firm would focus its management strategies on moving as many of those categories towards the upper end rating (9) as possible. The rating system could be devised from existing sustainability assessment tools. Labuschagne et al. (Labuschagne et al., 2007) have analysed key sustainability indicator frameworks used in businesses in South Africa<sup>107</sup>. They found that, after economics, the emphasis was on environmental aspects of sustainability and that social criteria did not receive adequate consideration. They discuss the four-sector theme indicator framework (with the addition of Institutional dimension to the ecological, social and economic domains) developed by the United Nations Commission for Sustainable Development. (See Figure 11.1). It is research such as this that can be used to provide

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<sup>106</sup> As Welty and Guarino WELTY, C. & GUARINO, N. (2001) Supporting ontological analysis of taxonomic relationships. *Data & Knowledge Engineering*, 39, 51-74. explain: "A property is not assumed to have any meta-properties until they are asserted by the modeler. To accomplish this ... each possible meta-property assignment is represented as a concept." P66

<sup>107</sup> Their review excluded frameworks that did not have measurable indicators (c.f. documentable indicators), but included frameworks that had environmental, social and economic indicators, with a wide focus and range across national, community and business levels, and which were not derivative of other frameworks. They did not consider product-only frameworks. Consequently, they reviewed: the Global Reporting Initiative (GRI); the United Nations Commission on Sustainable Development Framework; Sustainability Metrics of the Institution of Chemical Engineers; and Wuppertal Sustainability Indicators. LABUSCHAGNE, C., BRENT, A. C. & VAN ERCK, R. P. G. (2007) Assessing the sustainability performances of industries. *openUP*. Pretoria, South Africa. NP

sustainability-informed resources for firms to adapt their management approaches toward sustainability. The SISNA will be able to incorporate the diverse range and quality of data from such structures than would the ATO BIC.

#### **11.4.5 Relational database of sustainability-informed resources**

In addition to the four conceptual categories above, (functional properties, attributes, metaproperties and metatags) a key feature of the transition to SISNA is that the accounting narrative is to be housed in a relational database rather than a spreadsheet. This allows data to be metatagged according to function, attributes and metaproperties in ways that enable learning and reflexivity. The SISNA database would consist of fields linked relationally with other databases. The fields would include:

- Existing ATO line item code, augmented with decimal point to provide unique reference number. For example Medical research activities that are currently coded as part of the larger ATO BIC 69100 category for Scientific Research Services would have an individual code 69100.006. This would allow the new data to link to the ATO BIC categories for transition purposes and historical analysis.
- A code signifying the attributes of the activity. This would be linked to a database of attributes that evolves as the SISNA grows and the sustainability aspects of activities become increasingly differentiated as improved technologies and methods adapt and augment conventional ways of doing things. This capacity to differentiate the activity according to sustainability criteria is crucial to the evolution of the SISNA and its capacity to provide relevant data to policymakers as well as scope for ongoing learning and adaptation to new circumstances. It allows qualitative business innovation for sustainability to be incorporated into the

accounting narrative and rewarded appropriately with tax concessions.

- A set of codes to signify the sustainability-informed metaproperties. These would be linked to a database containing the metaproperties that have been collected and approved by the ATO. An activity would have a suite of metaproperties according to the different layers and dimensions of sustainability in which the activities impact. When registering with the ATO, a business would be provided access to an appropriate suite of metaproperties to consider as criteria to steer their management for sustainability. Choosing which metaproperties to address would be optional for the business, rather than a prescription from the ATO. The database of metaproperties could, in turn, be linked to a database of management systems for attending to various sustainability issues relevant to the business. For instance, if water efficiency emerged as a relevant metaproperty for a business, they could choose to incorporate this in their sustainability management strategy. The metaproperty database would be linked to another database with a set of existing water efficiency strategies that could be employed. Engaging in such management practices would allow the business to demonstrate its move towards sustainability to the ATO and thus move to a higher sustainability level and lower tax bracket. The managers of the SISNA would be charged with ensuring the databases of metaproperties and management strategies were kept relevant and up to date with indicator and assessment tools as they evolved. Thus, the capacity to continually adapt to changing circumstances, and to reward those who undertook sustainability-informed management would be an integral part of the system. A variety of dimensions of metaproperties can be included and organised for example, according to the theme indicator framework of the United Nations

Commission for Sustainable Development (Figure 11.1). For instance, the quality of life that a particular job perpetuates, or the extent to which a production process engages in sustainable practices, such as recycling or whole-of-life material analysis can be included and described with appropriate metaproperties<sup>108</sup>. As O'Connor (O'Connor, 2002) writes:

*... valuation for sustainability cannot be separated from the idea of actions whose effect is to sustain this or that form of life, way of life - in the cultural as well as ecological-economic sense.... it is no longer satisfactory to confine valuation attention to the produced goods and services alone, while ignoring 'ecological' determinants of wellbeing. p34*

- A set of fields in which the data from the business could be entered and organised on a regular basis. This would include scope for documentation of activities across a range of digital media, such as photographs for monitoring sustainability impacts across time. The database approach would augment indicators and assessment tools with qualitative data; it would remove dependence on quantification, monetisation and aggregation processes as sole providers of data for indicator and assessment processes.
- A field for the ATO tax file number would allow the SISNA data to be linked to income and expenditure data collected by the ATO.

The design and population of the databases would be an ongoing action research project for the ATO that would work to link business with policymakers within a broad framework in which sustainability and economics are symbiotic.

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<sup>108</sup> Many of the social objectives of sustainability correspond with the principles, aims and objectives of the co-operative movement of the 19<sup>th</sup> century, from which many significant businesses were developed. Examples from Western Australia include Wesfarmers Co-operative, Masters Dairy Co-operative, Swan Taxis Co-operative, Geraldton Fisherman's Co-operative. Wesfarmers Co-operative, for instance, initiated the radiostation 6WF which is now ABC Radio 720. Being asset rich, many co-operatives were de-mutualised in the late 20<sup>th</sup> century in the name of economic efficiency.

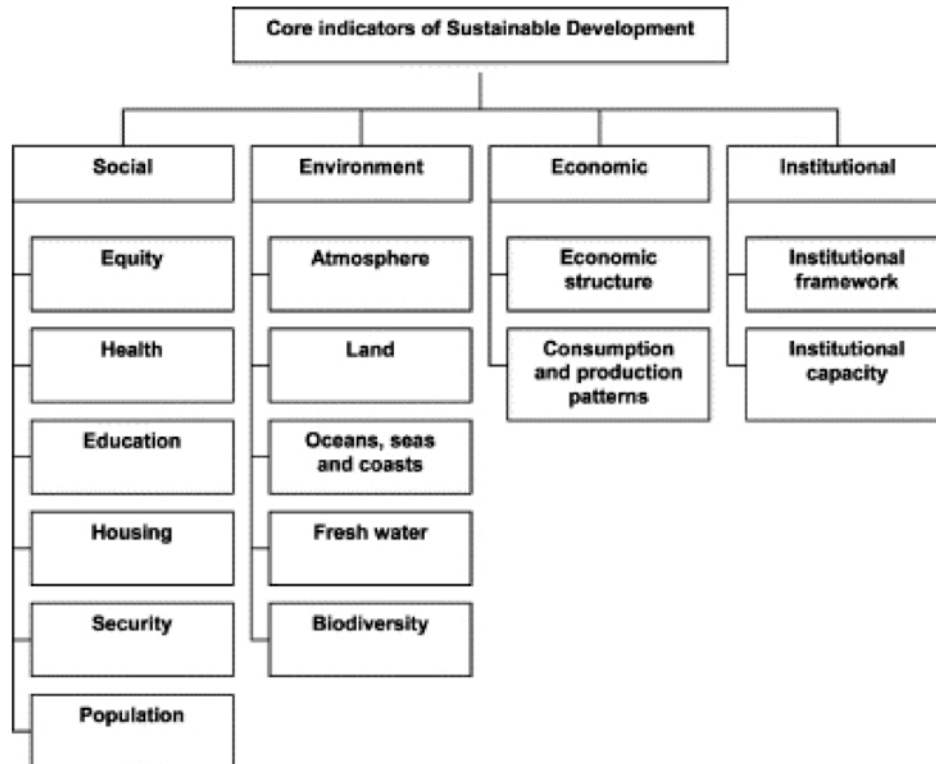


Figure 11.1: Theme indicator framework of the United Nations Commission for Sustainable Development (Labuschagne et al., 2007) (NP)

### 11.5 Adapting existing management and reporting frames for sustainability: EMS as example

In the tradition of building on existing processes, it is suggested here that the EMS 14001 framework could be adapted and enhanced for use by business as a sustainability-informed management system (SIMS). A Sustainability-informed Management System (SIMS) framework could be developed from the EMS 14001 framework. The incentive for businesses to take up an SIMS approach would be to demonstrate sustainability actions that are expressed in the new attribute-metaproperty classification system. Individual firms would be able to use it to make their case for inclusion in the lower tax brackets that are re-aligned to reward sustainable economic activities.

The EMS standard was developed in 1996 to provide a voluntary, enterprise-based framework to improve, in a demonstrable systematic manner, a business' responsible environmental management activities. The key steps for implementing

the EMS process are analysing the aspects of the firms' activities that create environmental issues, and then delineate the impacts that such activities have. This helps businesses to devise strategies to prioritise and manage them systematically (Andrews et al., 1999a, Andrews et al., 1999b). However, the current EMS approach has no overarching sustainability narrative to support and reinforce their initiatives.

A SIMS approach, in conjunction with an overarching SISNA would encourage extractive industries to adopt strategies to move toward sustainability with actions to minimise ecological footprint and ensure efficient use of resources according to multidimensional criteria that could be included in the accounting narrative.

### **11.6 Policy implications in practice: linking business sustainability with national sustainability policy**

By applying different tax rates, the ATO can encourage sustainability-oriented enterprise<sup>109</sup>. Businesses that steer their enterprise towards sustainability can be recognised and differentiated. Jordan (Jordan et al., 2003) suggests that mechanisms are needed to encourage willing involvement rather than enforcing acquiescence by government authority. Bressers (Bressers, 2004) explains that sustainability requires

*...highly interactive and cooperative mechanisms; the overcoming of value dilemmas; the building of international institutions; local empowerment; new partnerships between public and private decision-makers, and between them and NGOs. p284*

The proposed change is a reconceptualisation of the criteria used for defining tax brackets to encase sustainability-informed criteria. Tax brackets can be adjusted to make it viable for management to pursue sustainability-informed practices: it would be in the firms' interests because demonstrating sustainability means moving to a lower tax-rate. In this way, the SISNA is harnessing of creative entrepreneurial energy for sustainability-oriented economic activity, not punishing. Sustainability-oriented business strategies become an advantage for the firm, not a cost. Substantive creative activities are distinguishable from mere speculation or

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<sup>109</sup> Tarrant TARRANT, D. (2008) The Root of the Matter. *In the Black*, 38-41. P41 reported, a survey by CPA Australia in 2008 showed that 80% of businesses preferred a mandatory regulatory framework in which economic performance could be integrated with environmental and social aspects.

extraction, so the movement towards sustainability is symbiotic with economic policy. The crucial difference is that, in the SISNA, the criteria for tax assessment are based on reconceptualised, sustainability-informed ATO categories that are derived from sustainability-informed metadata and descriptors. Lower income earners are already assessed at a lower tax rate and would remain so in the changed system.

The SISNA makes the move towards sustainability easier because the quality, diversity and dimensionality of the information available at a national level is increased. The sustainability-informed national accounts becomes a more effective strategic policy tool because policies can be framed from multidimensional data organised according to sustainability understandings that link to real-world dynamics, limits and capacities. Policy makers will be able to encourage sustainability-enhancing activities, and dismantle non-sustainable parameters that perpetuate unsustainable behaviour.

Using the reconceptualised ATO categories will allow policy makers to consider options (as part of the policy learning process) based on pluralist perspectives and multidimensional understandings based on sustainability-informed data derived from businesses. A recalibrated national accounts system will provide policymakers qualitative and strategic information by which economic activity can be 'steered' towards sustainability.

From a policy perspective, the SISNA data are complemented by the Viability Analysis framework (discussed above) in which policy can be framed within a dynamic, multidimensional framework in which viability within layers and between domains is considered at all times.

Sustainability-informed accounts provide multidimensional data that allows policy to be adapted strategically to cyclical phases of change in biophysical, socio-cultural and economic layers. This contrasts with the neoclassical economics-based counter-cyclical approach to policy that is essentially focused on tempering boom cycles and stimulating in recession cycles. As explained above, this is non-sustainable because the inherent need for economic expansion to maintain stability is a critical aspect of the neoclassical economic framework: effective sustainability policy is not possible



if there is no acknowledgement of biophysical and socio-cultural limits to expansion. A single focus on counter-cyclical strategies to stop downturns and limit upturns does not respect the phases and stages of dynamic life cycles. Sustainability policies need to offer qualitatively different strategies for downturns (e.g. more focus on maintenance, refinement cultivation, preparation activities) and less emphasis on nullifying downturns through demand stimulation regardless of environmental costs. If the expansionist requirements needed for neoclassical economic stability are discounted by the use of an analytical framework that offers a greater variety of options and perspectives, then sustainability can provide *enrichment* as an economic focus, rather than merely *expansion*.

Sustainability-informed policy offers the option of co-cyclical strategies that can work with qualitative systemic parameters and limits as they move through various phases. The art of sustainability policy is to manage the decrease so that it provides a solid foundation for a strong cycle of increase; a spiral rather than a cycle of booms and slumps. From a sustainability perspective, working *with* cycles provides a different suite of policy needs and options. Already humans adapt lifestyle and activities to seasonal changes.

There are policy-oriented approaches already existing that provide macro perspectives on sustainability aspects. These are discussed more fully in the next chapter, but a preliminary list includes:

- transition management (Grin et al., 2011, Kemp and Loorbach, 2006, Loorbach and Rotmans, 2006, Rotmans et al., 2001, Sondejker et al., 2006)
- legal reform (Richardson, 2006, Richardson, 2008, Richardson and Craig, 2006, Richardson and Razzaque, 2006, Richardson and Wood, 2006a)
- institutional change (Arentsen et al., 2000, Astleithner et al., 2004, Connor and Dovers, 2004, Dovers, 2001, Opschoor and van der Straaten, 1993)

- reflexive governance (Beck, 2006, Bressers, 2004, Dovers, 2003b, Grin, 2006, Kemp and Loorbach, 2006, Lafferty, 2004a, Loorbach and van Raak, 2005, Rammel et al., 2004, Rip, 2006, Voss et al., 2006, Webb, 2005).

### **11.7 Impact of qualitative differentiations on market function**

The above approach ensures that sustainability is not a threat to market economics. Sustainability needs a free enterprise system to cope with diversity and complexity and to deliver the creative responses needed to manage unintended consequences and opportunities. Sustainability requires reflexivity, flexibility and adaptability. It cannot be achieved solely by regulation. Rammel, Hinterberger and Bechtold (Rammel et al., 2004) explain that governance for sustainability depends on the use of

*... open processes and continuous learning rather than in determined outcomes. Sustainable transitions cannot be managed in a controlling sense as they are driven and caused by a dynamic interplay between various complex and co-evolving processes, many of them are far beyond any certainty, control or predictability. p3*

The SISNA depends on multidimensional qualitative recalibration of activities as well as the flexibility and adaptability of free enterprise market. Sustainability-oriented activities need to be encouraged among businesses. The recalibration used in the SISNA will enable entrepreneurs to differentiate in their business plans between activities that inhibit and those that enhance sustainability and profit. Many businesses are already thinking along these lines (Tarrant, 2008).

The difference with the changes proposed here is that the accounting narrative now sits within a symbiotic sustainability narrative: firms are encouraged to move towards sustainability, not penalised.

The SISNA categories differentiate activities according to criteria other than market price. It reframes rather than impinges on the workings of a free enterprise market system.

The capacity to differentiate the validity of the purchasing power means that legitimacy and integrity are returned to market functioning.

The SISNA could improve market functioning because it improves the *effective* knowledge base for market participants insofar as it diminishes the influences of speculators in market function.

Without qualitative distinctions, the market cannot distinguish between biophysical efficient use of resources and waste. Although recycling programs are beginning to emerge, conventional market efficiency does not accord with efficient resource use. Innovative programs are emerging. An example is provided by Ritchey's (Ritchey, 2011) description of extended producer responsibility (EPR) in Sweden that imposes:

*... accountability over the entire life cycle of products and packaging introduced on the market. This means that firms which manufacture, import and/or sell products and packaging, are required to be financially or physically responsible for such products after their useful life cycle. They must either take back spent products and manage them through reuse, recycling or in energy production, or delegate this responsibility to a third party – a so-called producer responsibility organisation (PRO), which is paid by the producer for spent-product management. In this way, EPR shifts responsibility for waste from government to private industry, obliging producers, importers and sellers to internalise waste management costs in their product prices. p33*

This strategy for resource efficiency came from a policy framework outside direct control of price-based market function. Sustainability-informed approaches to framing market activities are a transcendence of the belief that *homo oeconomicus* provides the best conceptualisation of sustainability: *homo sapiens* have a wide range of behavioural strategies and options for deciding their behaviour. When particular behaviours or systemic parameters threaten survival, it is wise for behavioural options and organisational frameworks to be considered.

There are already options that policymakers may choose to reframe activities according to multidimensional criteria, and there is extraordinary computing power now available to collect, collate, organise, portray and disseminate data. O'Connor (O'Connor, 2002) proposes a 'logic of valuation' which enhances the sustainability-informed approach to accounting:

*It is not, in fact, necessary to base 'valuation' studies on speculative propositions about the money value of environmental assets and damages. On the contrary, a more modest (and, perhaps, also more robust) approach is to confine monetary aspects of valuation to the question of economic*

*resources that must be committed in order to meet specified hazards or categories of damage or to ensure the maintenance of specified dimensions of environmental quality... first make the proposition to sustain/conservate the forms of life or environmental features in question (for example, avoid the production of toxic wastes, preserve a designated forest system, or the biological diversity, or other features of nature), and then investigate what commitments this does or might entail. Pp41-42*

Recalibration of activities expands the range of criteria that can be applied for what is accounted, and the way activities are accounted. In particular, recalibration and reconceptualisation provide scope for policymakers to include the integrity of purchasing power used to express economic demand for goods and services. The need for market operations to be able to establish the validity of purchasing power was discussed above.

### **11.8 Implementing the changes: some change analogies**

Implementing these changes can be done incrementally and *in parallel* with the existing tax system by using an 'opt-in' approach. Businesses can choose to opt for sustainability pathways and engage with the sustainability-informed system of accounts. However, the neoclassical economists will want to assess the viability of sustainability changes according to their own criteria. This is akin to allowing alchemists to assess the validity of oxygen as an alternative to phlogiston. There is no way that oxygen would have been accepted had phlogistonists been the final arbiters of the new chemical awareness<sup>110</sup>. Therefore it is at this point that neoclassical economists need to be reminded that their interpretation of sustainability is inadequate for dealing with complex unintended issues; that their policy outcomes are iatrogenic and their policies exacerbate the issues they are meant to be resolving; and that their economic paradigm is not derived from immutable, neutral, universal natural laws.

This will take some courage, but the precedents of Lavoisier in confronting the Priestley and the phlogistonists, Wilberforce and the slave traders; the public health advocates and the medical profession, can provide historical support that it is

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<sup>110</sup> Although Priestley provided the experimental evidence for the existence of oxygen and ecosystem function, he nevertheless remained committed to phlogiston theory to the end of his days. He called oxygen 'de-phlogisticated air'. JOHNSON, S. (2009) *The Invention of Air*, London, Penguin, PRIESTLEY, J. (1796) Considerations on the Doctrine of Phlogiston, and the Decomposition of Water.

possible. Imagine trying to explain oxygen and ecosystems to alchemists; trying to convince slave traders that there will be economic adjustment but not long-term loss; trying to convince Florence Nightingale that hygiene was killing germs to prevent infection, it wasn't just a question of cleanliness being next to godliness. Even worse, imagine those paradigms had not been challenged and we were still living under the misapprehension that the world was made of four elements, that minerals were evolving by processes of transmutation, that ice, water and steam were different substances, that slavery was justifiable economic progress, that diseases were airborne humours carried by miasma, that bloodletting was the basic cure for malady.

The move to change *towards* a sustainability-informed accounting narrative, and *away* from an economics-dominated discourse exposes the epistemological rivalry between economics and politics. As Lafferty (Lafferty, 2004b) reminds us:

*...the relationship between dominant Western democratic norms and practices and the apparent functional exigencies of the [sustainable development] programme is much more conflictual than generally assumed. ... One should not expect that a programme that has as its principal objective the transcendence of an unhindered and non-reflective market-liberalism, should find itself in harmony with that system's form for democratic governance. Nor should one be overly nervous about the problematic itself. ... Democracy has always had to adapt its form to contemporary functional demands; and it is the business of architectural political science to aid in the transition. Democracy for a sustainable society can clearly look different from democracy for a liberal-pluralist market society - without losing its essential democratic nature. Form follows function - but not without help. p360*

It is well to remember that President Eisenhower introduced the new math into the school curriculum as a policy decision. It was made on the grounds that arithmetic-based maths was no longer adequate for the science age. That is, it was a policy decision to reframe the analytical framework because the old one, despite being used for centuries, was not longer adequate. The parallel with the contemporary situation is that an inadequate and inappropriate economic framework is being used to frame sustainability policy. A change to the overarching approach to accounting is necessary.

### 11.9 Conclusion

The opportunity for conceptual change exists because a taxonomy of business activities and occupations already exists: the Australian Tax Office List of Businesses Industry Codes (Australian Government Taxation Office, 2005). This list is used by accountants to categorise businesses when they apply for an Australian Business Number (ABN) that is a necessary part of registering a business in Australia.

The existence of the ATO list of business codes means that the processes of reconceptualisation, restructuring and recalibration, as described above, can begin as a process of adaptation of existing practices, not as a totally new initiative. This accords with the basic principles of transition management (Loorbach and Rotmans, 2006, Sondejker et al., 2006), one of the more sophisticated approaches for moving towards sustainability.

Continued use of the conventional framework means that policymakers consider only two options for remediation: austerity measures or economic expansion packages. The first imposes unnecessary hardship and reflects 19<sup>th</sup> century attitudes and perspectives. The second perpetuates the processes that are creating sustainability issues. The proposal in this chapter points to a third route: sustainability.

The Inspector General of Taxation would be a professional officer within the ATO who could be approached for discussions about adapting the coding system by which activities are described.

A reconceptualised and restructured ATO BIC can facilitate the development of a symbiotic relationship between sustainability and economics because such changes create scope to recalibrate economic activity within a sustainability-informed ontology. This in turn creates scope for cognitive and conceptual change and ongoing learning that is necessary for sustainability policy.

The SISNA can be used to frame sustainability policy and it can provide guidelines for businesses to move toward sustainability to improve efficiency (in all levels) and profitability. The analysis needed to inform sustainability policy, and provide

guidelines for ongoing adaptation of the SISNA narrative is framed within the Viability Analysis framework.

The SISNA framework creates scope for a symbiotic relationship to be established between sustainability and economic activities within the ATO framework.

Community, policymakers and businesses will be able to use the SISNA as a guide to sustainability. It is an overarching narrative that means that viability evaluations are encased within a sustainability framework: thus it helps overcome the operational paradox described above in which sustainability considerations were marginalised because they were too complex to put into operation.

In summary, the adaptation process involves:

1. A shift from the source-based criteria by which activity is counted and the emphasis on aggregation as the prime tool of analysis, to a sustainability-informed, multidimensional categorisation of attributes and metaproperties that are qualitative and provide more flexible forms of interpretation and analysis.
2. Contextualising economic activity within a sustainability-informed ontology that appropriately ascribes significance to activities according to sustainability criteria. Accounting becomes a sustainability-informed narrative that is no longer solely dependent on QMA processes. The reconceptualised sustainability-informed ontology is used to derive the attributes and metaproperties of the activities that are included in the categories of the taxonomy of accountability and the analysis of viability.
3. Organising activities in a sustainability-informed taxonomy built from categories that are amenable with sustainability policy. This provides scope for ongoing adaptation of accounting as new activities emerge – for example, as sustainability creates new business opportunities not previously considered.
4. Calibrating economic activities according to sustainability-informed attributes and metaproperties so that they sit within the categories of the

sustainability-informed taxonomy. New metatags can be developed by sustainability researchers and policymakers as new understandings emerge. This will facilitate the workability of this aspect of the accounting narrative. The accounting process will be housed in a relational database to allow multidimensional (and multimedia) data to be stored and accessed efficiently. It will also allow appropriate pre-existing sustainability assessment tools and indicators to be accessed by individual firms wanting to make their enterprise more sustainable.

5. Ongoing learning about sustainability issues, policy processes and social pluralism facilitated by the dynamic adaptive capacities of the SISNA structure. Ongoing learning will stimulate cognitive and conceptual development to match the evolution of the sustainability concept and new understandings of complexity and uncertainty as they emerge. This leads to iterative review of attributes and metaproperties used to distinguish categories of activity within the SISNA.

Advantages of the SISNA approach include:

- more adequate/realistic portrayal of reality; accommodates complexity; provides other than economic perspectives
- more objective indicators and assessment of economic activity for ongoing wellbeing and improvement
- opportunities arise for hybrid accounting systems to move to centre stage of public policy, rather than being marginalised as satellite accounts
- enables strategic, sustainability-informed considerations to steer public policy – much as public health reforms steered society to healthier ways of living
- provides opportunities for ongoing learning because accounting narrative is structured according to cognitive psychological



parameters that facilitate conceptual and cognitive change (dynamic framing, nested hierarchies, graded concepts); the sustainability-informed categories provide scope for ongoing development, adaptation and conceptual refinement.

- more efficient long term use of non-renewable resources because market operations incorporate the validity of purchasing power: energy efficiency, recycling, etc become positive attributes in the accounting narrative
- a symbiotic relationship between sustainability and economic activity is developed: sustainability becomes economically viable, economic viability becomes sustainable.

The sustainability-informed system of national accounts creates a suite of new policy options, systemically supported opportunities for sustainable enterprise and many meaningful research opportunities for economists <sup>111</sup>.

The overarching considerations of sustainability set the parameters in which economic aspects are considered. The monodimensionality of the QMA approach is replaced by a contextualised sustainability-informed approach. As a result, economic policy is no longer derived from inadequate perceptions of reality, driven to iatrogenic outcomes through inappropriate policy analysis that is framed within parameters that are incommensurable with other sciences.

In the next chapter, the elements of a sustainability-informed policy framework that can encase the Viability Analysis framework and the SISNA are discussed. These elements are distilled from existing literature and research.

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<sup>111</sup> The profession of economics may even have its own category in the SISNA taxonomy!

## Chapter 12: Towards a sustainability-informed policy framework

### 12.1 Introduction

The purpose of policy is to accommodate uncertainty within the decision-making processes. Stirling (Stirling, 2006) states:

*The more accepted the concept of sustainability becomes, the more obvious are the shortcomings of current forms of policy making and knowledge production. The departmentalisation of policy making and the isolation of research disciplines cannot provide the integrated solutions needed to pursue sustainable development. p273*

A policy framework exists to provide legitimacy for decision-makers to act. This legitimacy is derived from competence, well-founded knowledge, transparency, engagement, and processual fairness. Bressers and Rosenbaum (Bressers and Rosenbaum, 2000) explain that the challenge for effective sustainability policy is to

*...reconcile the functional rationalities of economic efficiency and dynamic ecological stability ... with the procedural rationality of democratic decision-making. p533*

The sustainability framework proposed here is a tool for framing issues in ways that better reflect and accommodate complexity (De Greene, 1993b); it is designed to provide a context in which policy responses to issues can be framed within parameters, principles and processes that reflect sustainability perspectives, and where economic considerations are part of the paradigm, not the determinants of policy approaches. This requires cognitive and conceptual changes based on new understandings of system dynamics, such as emergence, co-evolution, non-linear causality, nested hierarchies, cascading causality, life cycle analysis (LCA)<sup>112</sup> and synergy. These understandings were not available when the neoclassical economic framework was formulated. New varieties and *types of thinking and qualities of information* are needed to manage the way that information is organised and used

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112 "...life-cycle assessment (LCA) in the development phase of new products and services is helpful to find out early on whether or not a product or service has a potential to contribute to sustainability. In order to fully explore such a potential, however, the analysis cannot be restricted to the environmental and economic situation but has to take into account the social and institutional goals and criteria." SPANGENBERG, J. H. (2001) Sustainable development : from catchwords to benchmarks and operational concepts. IN CHARTER, M. & TISCHNER, U. (Eds.) *Solutions: Developing Products and Services for the Future*. Sheffield, Greenleaf. P37

(Sikor and Norgaard, 1999); different types of learning are also needed. As Rotman (Rotmans, 2006) explains:

*.... the nature and context of a new generation of societal problems, called persistent problems, require[s] a new way of thinking and acting. p7*

Rather than inventing a new policy framework, the vast existing body of sustainability policy literature can be brought together without the tacit biases of myopic economic interpretations. Decision-makers can move beyond analytical and methodological constraints of discounted futures, monetisation of intangibles and non-market items, conceptualising unintended consequences as externalities, constraining policy options by deference to the imaginary concept of Pareto efficiency, regarding tradeoffs and opportunity costs as the basic mechanics of decision making, and relying on flawed cost benefit analysis methodologies to justify decisions. A sustainability-informed economics is needed to countervail those aspects of policymaking and replace the simplistic policy parameters of neoclassical economics.

Sustainability policy needs to abide by the limits and laws of nature, accommodate complexity, have appropriate flexibility to deal with emerging unexpected issues, allow iterative decision-making processes, have an adequate accounting narrative and monitoring capacities, and also provide scope for learning among policy makers as new understandings emerge to help the concept of sustainability continue to evolve.

One of the key findings of this research is that, for sustainability policy to be effective the processes of simplification of complex issues into monodimensional economic criteria need to be countervailed. Neoclassical economics is one of the key frameworks by which diverse and complex real-world sustainability issues are homogenised into simplistic causal relationships and concepts. The critical issue is firstly that the abstract methodologies, models, concepts, episteme and narrative of neoclassical economics plays a determining role in framing contemporary issues, and what approaches to their remediation are deemed to be viable, and secondly, that the neoclassical economic framework by which these decisions are made is itself inherently non-sustainable and inadequate.

Chapter 9 described a framework in which various dimensions of viability could be incorporated into the analytical processes on which sustainability policy can be based so that economic considerations were not the dominant criteria for implementation; dominant in the sense that treasury departments normally have the final say in decisionmaking (Roseveare, 1973). However, a sustainability-informed economics needs diverse and multidimensional aspects in a policy framework to ensure that the broad goals of sustainability can be incorporated in decisionmaking processes. The challenge therefore is to develop an approach to policy that can encompass the complexities and diversity of sustainability, in which the economic dimension is used to augment the aspects affecting sustainability, rather than dominating the proceedings. Ways in which accounting can be recalibrated to enhance this process were discussed in chapter 11.

The next section discusses some of the elements of a sustainability-informed policy framework that can be used to augment a sustainability-informed approach to policy.

## **12.2 Elements of a sustainability-informed policy framework**

### **12.2.1 Parameters**

The basic parameters are that theoretical analysis should

- a) be compossible with the limits of nature
- b) be commensurable with the basic laws of physics and other scientific understandings, and
- c) have an adequate representation of the reality – such as biodiversity, irreversibility of life, system dynamics, socio-cultural diversity – as the basis for analysis.

In relation to compossibility, policymakers need to devise approaches that do not irrevocably disrupt natural ecosystem function, recognise the limits of biophysical dynamics, and move towards symbiotic ways of being in a post-industrial world.

In relation to adequacy, this means, for instance, that considerations of biodiversity should not be subservient to abstract assumptions of substitutability among resources, and that socio-cultural diversity and quest for human excellence and development should not be subservient to the procedural assumption of functional equivalence among humans.

The neoclassical economic approach is unable to accommodate the concept of limited expansion that is constrained by biophysical limits because, according to their static analytical framework, that would be destabilising to the economic system. Neoclassical economic theory creates iatrogenic policy outcomes as a result of an inadequate conceptualisation of complex reality. Continuous expansion contradicts the laws of thermodynamics and contemporary understandings of biophysical limits. Consequently neoclassical economics is unable to accommodate the fundamental sustainability parameter that policy needs to be framed within biophysical limits. The capacity of ecosystems to absorb waste and pollution is not accountable in the neoclassical economic paradigm.

### 12.2.2 Principles

Dovers (Dovers, 2003b) explains that sustainability is

*... most often described in greater detail in terms of broad principles (e.g. inter-generational equity, precaution, integration of ecological, social and economic policy), or subsidiary issues (e.g. biodiversity, climate change, human development). These descriptions usefully flesh out the nature and implications of the sustainability agenda. p2*

The principles that the concept of sustainability endorses:

- intergenerational equity
- the precautionary principle
- generational equity (social justice)
- ecological integrity
- effective and inclusive public participation
- legal transparency

- adaptive governance
- cultural respect and integrity.

Sustainability principles are evolving (O'Connor et al., 1998). A sustainability-informed policy framework based on sustainability principles does not eradicate disagreement, but it allows many of the contested aspects of the sustainability to be discussed and reframed in a broader context.

Below the two cornerstones of sustainability principles for policymakers are set out.

The principle of intergenerational equity (Cumberland, 1991) is a cornerstone of sustainability. It allows the future to be considered as an opportunity to enhance, rather than discount the needs of future generations (Froger and Zyla, 1998).

Conventional policy discounts the future. This favours extraction and exploitation of resources over cultivation and nurturing activities. O'Connor (O'Connor, 2002) explains that

*... discounting combined with NPV-optimizing appears to provide a rationale for displacing environmental damage onto the most vulnerable groups - poorer people first of all, since the money value able to be placed upon damage by/for poorer people based on 'willingness to pay' or money-income losses will (ceteris paribus) be less than the valuations by/for richer people; and future generations subsequently, because damages felt in the future will be evaluated as smaller than the same dollar value of current damage consumption. ... apart from scientific uncertainties about economic and ecological evolutions, there are also irreducible social obstacles to specification of opportunity costs in monetary terms, linked, for example, to notions of rights to life or property for other people or other species; to people's individual and collective sense of the sacred; or to natural or built features that are paramount matters of local identity. Pp40-41*

The discount rate is a cultural disposition that pervades policy decision-making; it advantages the present generation and is deeply entrenched in economic thought, but it is not a law of nature (Knetsch, 1994).

A zero or negative discount rate could be a powerful policy tool by which the viability of actions can be constructed to be in favour of future generations – and sustainability.

Precaution is another critical aspect of sustainability policy, described in Principle 15 of the Declaration on Environment and Development made at the 1992 Rio de Janeiro conference (Stirling, 2006). Stirling (Stirling, 2006) explains that the precautionary principle is designed to be an aid to decision-making because it

*...involves the adoption of more long-term, holistic, integrated and inclusive social processes for the exercise of explicit and deliberate social choice among contending scientific and technological trajectories... p254*

It provides a general framework for incorporating risk, uncertainty, ambiguity and ignorance into the policy approach, especially where there is the likelihood or possibility of irreversible damage (Stirling, 2006).

The precautionary principle is controversial and contested<sup>113</sup> because it is subject to interpretation and manipulation. However, these contested aspects of the precautionary principle can be seen in a positive light because they create a dialogue among plural perspectives, and thus help to moderate the tendency for mono-dimensional specialists to dominate the approaches to complex issues. The basic idea is that decision-makers should be pro-actively cautious. Stirling (Stirling, 2006) suggests that when used constructively, it provides a means by which the subtle aspects of complex issues may be teased out and brought into the decision-making policy process:

*When precaution is understood as a social process, rather than as a formulaic decision rule, a number of analytic, institutional, juridical, commercial and regulatory implications begin to grow clear...p251*

In a world of complex, non-linear causal relations, the neoclassical economic notion of optimality is an imagination passed on from an outmoded epistemological

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113 "... the various formulaic statements of the 'Precautionary Principle' are found themselves to be vague, circumscribed and underdetermining (Morris, 2000). Under the statement of precaution cited above, for instance, what implicit threshold of likelihood is embodied in the notion of a 'threat'? How 'serious' is 'serious'? How are we to define 'irreversibility'? By what means and under what authority can the degree of 'scientific certainty' be judged? What is the most appropriate metric of 'cost', and to whom? With respect to what end are we to measure 'effectiveness'? In short, these kinds of questions appear simply to reproduce many of the same issues that qualify and limit the straightforward applicability of reductive aggregative risk-based approaches to which challenges, precaution is ostensibly a response. Were the critics of precaution inclined to use this kind of social scientific language, they might find the persistence of these ambiguities as an indication of a comparable lack of reflexivity, to that with which risk assessment itself stands charged." STIRLING, A. (2006) Precaution, foresight and sustainability: reflection and reflexivity in the governance of science and technology. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar. P250

paradigm. Optimality is part of the ideal-type approach to analysis, aiming to make the real world match the abstract ideal. It is claimed this process helps elucidate key variables that may be significant for analysis.

However, Dovers (Dovers et al., 2001b) p18 explains that striving for optimality runs counter to the precautionary principle because prudent sustainability policy incorporates a buffer against the unexpected. Optimality, on the other hand, strives to take resource use to the margin to ensure efficiency.

For reasons of brevity, the remaining principles are not discussed in detail here.

These discussions have been the subject of many papers<sup>114</sup>.

### 12.2.3 Perspectives

The sustainability perspective needs to accommodate different and competing narratives, interpretations, and cultural values. It needs to be more than an economic interpretation because complex issues have a 'multiplicity of perspectives on a situation' (Funtowicz et al., 2002) p53. A pluralist, multilayered approach allows issues to be addressed in a variety of ways and a diverse set of priorities for action to be considered. Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) argue that

*... no single legitimate perspective can provide a comprehensive or adequate vision of an issue... indeed it would not make sense to exclude all other legitimate perspectives in favor of one. However, a reductionist tool... is usually a representation of a single legitimate perspective. As a result lack of methodological pluralism can compromise the outcome of the decision making process to a great extent. p248*

A sustainability framework needs to accommodate dynamic, diverse and pluralistic aspects. A robust, sustainability-informed cultural narrative can encase these diverse perspectives. It needs to facilitate understanding of the complexities of issues, the evolving conceptual aspects of sustainability, and the new limits that sustainability awareness places on individual and institutional behaviour.

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<sup>114</sup> There are many other important aspects of sustainability worthy of discussion as well. For instance, the concept of sense of place SEDDON, G. (1972) *Sense of place : a response to an environment, the Swan coastal plain Western Australia*, Nedlands, W.A., University of Western Australia Press. is a critical grounding point for sustainability considerations; it is the point from which policy starts. However, it is a major research topic in itself.



### 12.2.4 Processes

The complexity of issues facing sustainability policy makers requires that different decision-making processes be employed. Voss and Kemp (Voss and Kemp, 2006) explain that uncertainty requires adaptivity within cognitive, institutional and technological domains to facilitate learning and allow for errors:

*This process necessitates the capacity to respond to unexpected effects and developments. Strategies should feature experimentation, monitoring and evaluation so that they may respond systematically to new experiences, altered interpretations and changed circumstances. p18*

Sustainability policy needs to be process-centred, not goal-oriented; it is more of a process of adaptive steering than one of making and adhering to fixed decisions, yet not incrementalist without vision either. Implementing sustainability policy is not a process of "...formulation-and-decision in a vertical chain-like relationship" (Hill and Hupe, 2002) but more a task of identifying and mapping general issues and ascribing authority to steer policy within a governance process (Lafferty, 2004b).

Sikor and Norgaard (Sikor and Norgaard, 1999) explain that:

*... it is important to shift the emphasis from the goal of sustainability defined a priori ... that is presented as timeless and universal across people, to the conditions under which appropriate goals can be constantly assessed and worked toward by the people involved. p53*

Consequently an assortment of multifaceted, open-ended approaches are needed that incorporate and facilitate experimentation, adaptation and participation within amenable institutional structures. Processes need to be iterative, so that new information as well as emergent conditions can be used to facilitate adaptive management strategies.

#### 12.2.4.1 Governance for sustainability

The term governance refers to approaches that are inclusive of non-government agents (Dovers, 2005b) and emphasise cooperation rather than assertion. Lafferty (Lafferty, 2004b) describes governance as a steering process that involves many actors and stakeholders to be involved in the governance processes.

The move towards governance signifies a general trend away from regulation as the principal means for affecting change (Lafferty, 2004c). It acknowledges that policy-

receivers deserve input into the policy-making processes (Lafferty, 2004c). In a governance approach, the role of the government is one of legitimising and enabling the process of governance so that policy processes are open and responsibly enforced so that resources needed for effective policy are made available (Bressers and Rosenbaum, 2000).

This perspective contrasts with that in which the role of government is seen as the creator of coercive instruments to implement policy. In governance approach, the role of government is to establish relevant parameters and provide the structures that ensure the policy processes have credibility, legitimacy, efficacy, salience and accountability that engender broad support for policy. The relation between governance and the cultural narrative is evident here; hence the importance of ensuring sustainability and governance are symbiotic.

The concept of governance was introduced in the late 1980s (Kemp et al., 2005). The early emphasis of governance was on economic policy instruments, but has gradually shifted towards other policy instruments to encourage behavioural shifts among individuals as well as in the broader community (Lafferty, 2004c). According to Rammel, Hinterberger and Bechtold (Rammel et al., 2004), the governance concept has gradually broadened to encompass 'all interaction and decision-making processes in state, market and civil society' p19.

In the European Union, good governance is taken to consist of five main principles: "openness, participation, accountability, effectiveness and coherence" (Rammel et al., 2004) p19. These principles were developed to connote "a positive concept of governing" (p19) that could help distinguish between aspects of economic development that create negative outcomes, from more developments that create desirable outcomes.

A governance approach acknowledges that, in an interdependent globalised world, there are limits to the capabilities of government, and that the role, boundaries,

style and scope of government, and their capacity to implement<sup>115</sup> policy has changed.

Durant (Durant et al., 2004) argues that taking a governance approach is to acknowledge that “purely market-based, government-based, or community-based solutions” are not capable of resolving contemporary complex issues; they require a meta level of thinking that transcends the framework in which the issues emerged in the first place (Espinosa and Walker, 2011). Rammel, Hinterberger and Bechtold (Rammel et al., 2004) explain that governance for sustainability aims to be proactive to induce change at a variety of levels, among individual actors across different time frames and spatial scales:

*Socio-economic systems are moving targets with multiple futures that are inevitable unpredictable and uncertain.... conventional policy approaches relying on control and static optimisation cannot tackle the objective of sustainable transitions. Consequently, governance and policies for sustainable development are challenged to be adaptive, flexible and experimental at scales compatible with the scales of critical socio-economic functions. p24*

As the implications of the ‘age of complexity’ (Harris, 2007) have continued to emerge, the usefulness of the notion of ‘governance’<sup>116</sup> for policy approaches for sustainability has become more apparent<sup>117</sup>. A governance approach acknowledges the dynamics and complexity of issues and the futility of attempts to apply simplistic approaches to problems, or to attempt to eliminate uncertainty. As Lafferty (Lafferty, 2004c) explains, governance approach

*... reflects the humility of acknowledging that we don't know everything; that*

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115 “Nor can governments rely on hierarchical authority to impose their will on other actors, as they might at one time. Governments do have authority, but have become more reluctant to manage policy problems through hierarchy alone. Rather, networks of private and public actors surround each policy area, and their interactions often are as determinate as are direct government interventions.” BOVENS, M. A. P., HART, P. T. & PETERS, B. G. (2001) Analysing governance success and failure in six European states. IN BOVENS, M. A. P., HART, P. T. & PETERS, B. G. (Eds.) *Success and failure in public governance : a comparative analysis*. Cheltenham, UK, Edward Elgar. p12

116 “.... the multi-dimensional and dynamic concept of sustainability ... has fundamental implications for the governance of modern society.” VOSS, J.-P. & KEMP, R. (2006) Sustainability and reflexive governance: introduction. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar. p3

117 “The notion of governance fits in with complex systems approaches to understanding the workings of the policy process through the inter-relationships among identifiable parts (e.g., social, cultural, economic and ecological), rather than just the parts themselves. A complex systems approach to governance also implies explicit appreciation of complexity and uncertainty, likelihood of surprise and need for flexibility and adaptive capacity.” KEMP, R., PARTO, S. A. & GIBSON, R. B. (2005) Governance for sustainable development: moving from theory to practice. *Int. J. Sustainable Development*, 8, 12–30. p17

*there may be unintended consequences. p5*

As Hartzog (Hartzog, 2011) explains that chaos and complex adaptive systems approaches need to be embraced by governance systems. Pahl-Wostl (Pahl-Wostl et al., 2008) suggests that use of 'governance' represented a change in thinking about policy approaches. Hill (Hill and Hupe, 2002) suggests that there is a central link between implementation and governance. Richardson (Richardson, 2002) describes governance as combining different sets of discursive processes, rules and incentives used to steer and co-ordinate stakeholders and community in general.

Kemp, Parto and Gibson (Kemp et al., 2005) p17 suggest that governance:

*... encompasses a broad set of factors that are insufficiently recognised in conventional thinking. It encourages a more integrated understanding of how these factors were, or should be, linked. ...how one gets to act, through what types of interactions (deliberation, negotiation, self-regulation or authoritative choice) and the extent to which actors adhere to collective decisions. p17*

In relation specifically to sustainability, a wide range of governance approaches (Grin et al., 2011, Dovers, 2005b, Voss et al., 2006, Froger and Zyla, 1998, Espinosa and Walker, 2011, Kane, 1999, Kohn, 1999a, Rammel and van den Bergh, 2003), legal frameworks (Richardson and Wood, 2006b), management strategies (Burritt, 2005, Connor and Dovers, 2004, Costanza and Wainger, 1991, Dovers et al., 2001a, Kemp and Loorbach, 2006) and engagement tools (van de Kerkhof and Wieczorek, 2005, Sarkissian et al., 2009, Stocker et al., 2012, Meadowcroft, 2004, Tàbara and Pahl-Wostl, 2007) has been developed to bring about changes.

Voss and Kemp (Voss and Kemp, 2006) suggest four main features to which a governance framework for sustainability needs to respond:

- *the complexity of interlinked social, technological and ecological development,*
- *the fundamental uncertainty with respect to system dynamics,*
- *the ambiguity of sustainability criteria and assessment and*
- *the contingency of the effects of human action in the context of long-term system change. p7*

A governance approach emphasises adaptation to changing conditions, and recognises that there is no single, optimal way of doing things.

Three key aspects of governance for sustainability emerge as critical to any response:

1. the need to develop institutional frameworks in which policies are able to be developed and implemented in a context of uncertainty and incomplete knowledge, where there are potentially irreversible consequences from both action and inaction. Such processes need to facilitate public engagement in decision-making<sup>118</sup>, encourage the learning processes necessary for understanding complex issues (sustainability learning), new decision-making processes (policy learning) required by uncertainty, and understanding the need to respect pluralist perspectives on issues (social learning)
2. the need for learning and reflexivity to accommodate new understandings of complex issues and the context in which they emerge and the need to avoid a simplistic interpretation of sustainability.
3. the need to facilitate community engagement in the creation and dissemination of a robust sustainability narrative that supports a cultural epistemology framed within a sustainability-informed ontology. Such a narrative is necessary so that implementing sustainability initiatives is validated and facilitated by the conventional wisdom of the general public<sup>119</sup>.

These aspects of learning and sustainability were discussed in chapter 8.

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<sup>118</sup> “Our transdisciplinary approach does not only rely on the input of scientific knowledge and expertise, but also on participatory research...action research plays a prominent role as well. The exchange of knowledge between scientists and societal actors to which our approach gives rise does not follow a linear path, but rather entails a societal process of co-production between the parties involved.” GRIN, J., ROTMANS, J. & SCHOT, J. (2011) *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*, London, Routledge. p107

<sup>119</sup> The importance of cultural narrative in uptake of innovations is often underrated. HOLMES, R. (2008) *The Age of Wonder: How the Romantic Generation Discovered the Beauty and Terror of Science*, London, Harper Press. describes the debate among medical historians as to why the innovative chemist Sir Humphrey Davy did not make the conceptual leap to anaesthetics even though he experimented with nitrous oxide on himself: “Several scholars suggest a ‘cultural’ as much as a technical inhibition. They argue that the late 18<sup>th</sup> century attitude to pain, in a surgical context, did not admit to the concept of a ‘pain-free’ operation. Pain itself was a natural and intrinsic part of the surgical procedure, and a surgeon’s ability to handle a patient’s pain .. was an essential part of his profession. In a word, there was the need for ‘a paradigm shift’ to conceive of pain-free surgery.” P 284 n

### Governance and institutional framework

Institutional arrangements frame the way issues are perceived and approached and thus impact significantly on all aspects of sustainability policy (O'Toole, 2004). The institutional context in which policymaking occurs affects the likely success and acceptability of a governance approach. Rotmans (Rotmans, 2006) states that sustainability requires:

*...a revision of both development processes and the institutions in which the underlying system failures take place; a re-orientation [and] different form of governance and planning, shifting away from the old directing and controlling mode; a different form of planning for the persistent problems that mark unsustainability trends in our current society. p6*

Dovers and Wild River (Dovers and Wild River, 2003) present a detailed set of attributes for adaptive institutions based on institutional theory, the nature of sustainability issues and management approaches that have exhibited relative success over time. However, as Dovers and Wild River (Dovers and Wild River, 2003) warn, existing institutional frameworks may have some or all of these adaptive capacities but effecting changes in institutional practise is not easy. Nevertheless the challenge of developing a reform agenda needs to be addressed.

### Governance and learning

Conveying the implications of complexity to the broader academic and general community is a major challenge for sustainability policy and social learning strategists<sup>120</sup>. Sendzimir (Sendzimir et al., 2006) explains the learning process as an iterative cycle in which surprise is expected. This embracing of uncertainty means that management is expected to be an evolutionary exercise, based on accumulated understanding and adaptive responses.

### Governance and reflexivity

Reflexivity is a crucial aspect of governance structures and processes for sustainability. Reflexivity is a mental technique by which the consequences of the

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120 "... this will mean considerable adjustment in the Western gestalt, and here education must play a significant role. Educators must recognize the need for a comprehensive, metadisciplinary approach... Appending ecological considerations onto neoclassical economic theory may be a temporary measure for slowing such crises as climate change, but it cannot produce a satisfactory long-term outcome." CLARK, M. E. (1991b) Rethinking Ecological and Economic Education: A Gestalt Shift. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press. p410

decisions themselves are integrated into the overall process. Voss and Kemp (Voss and Kemp, 2006) claim that reflexive governance<sup>121</sup> helps manage the unwieldiness of adaptive and iterative processes. It has inbuilt feedback mechanisms and incorporates iterative processes and adaptive learning as a way of accommodating complexity and managing uncertainty. Voss and Kemp (Voss and Kemp, 2006) explain that:

*... an integrated review of reflexive governance innovations helps to shift the debate about the usefulness of the concept of sustainability from immediate outcomes to more hidden process innovations and ways of structuring and handling problems. ...reflexive governance, comprises both the condition of being shaped through its own side-effects and the transcendence of this cyclic pattern through reflection of the modern understanding of rationality itself. ...[It is] geared towards continued learning in the course of modulating ongoing developments, rather than towards complete knowledge and maximisation of control. Pp6-7*

Stirling (Stirling, 2006) adds

*...the influence of more reflexive social scientific understandings, though often tacit, are beginning to be positively felt in discourses on precaution in sustainable governance. This becomes most evident in considering the question of what might be called 'precautionary appraisal' the means by which precaution informs wider processes of social learning and decision-making... Here attention turns away from attempts to characterize the substance of an intrinsically intractable problem definitively. Instead, **the focus lies more pluralistically in the process of responding to this problem**...p251 (My emphasis)*

#### Governance and community engagement

A governance approach can foster an inclusive relationship between citizens and government that can be used to synergise with sustainability. Sikor and Norgaard (Sikor and Norgaard, 1999) explain:

*The challenge of sustainability is to develop social processes that integrate diverse views of sustainability and create sufficient opportunities to satisfy future demands on resources. p53*

Nevertheless, on grounds of efficiency there is a reluctance to undertake community engagement. Community engagement represents a shift in emphasis

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121 "Reflexive governance refers to the problem of shaping societal development in the light of the reflexivity of steering strategies - the phenomenon that thinking and acting with respect to an object of steering also affects the subject and its ability to steer. Examples of such reflexivity include research policies bringing up new knowledge that shifts policy objectives, or subsidies increasing the lobbying power of supported industries and thereby changing political force fields." VOSS, J.-P. & KEMP, R. (2006) Sustainability and reflexive governance: introduction. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar. p4

from outcomes to process. O'Connor (O'Connor, 2002) explains that even when pluralism and flexibility are used to develop options, the need for choices about goals and priorities still have to be made.

Weaver and Rotmans (Weaver and Rotmans, 2006) suggest a four-stage process for developing stakeholder interaction, consisting of creating an approach to issues, developing a suite of scenarios for various options for action, formulate specific policy proposals, develop supportive narratives as vehicles for dissemination of the policy proposals.

An inclusive, open-ended approach to policymaking provides an avenue for citizen-science, Indigenous and other knowledge systems to contribute to the policy process (Dovers and Connor, 2006, Richardson and Craig, 2006). If properly engaged, a diverse epistemological approach and broader knowledge base emerges that can lead to more effective implementation of strategies (Stirling, 2006)<sup>122</sup>.

Sustainability policy processes need to be encased within democratic ideals, actively encouraging open and effective participation. Participation is critical to a robust sustainability narrative that can legitimise sustainability policy in the community. Social engagement increases the efficacy of policy because target groups and stakeholders are involved in the debate. Bressers and Rosenbaum (Bressers and Rosenbaum, 2000) explain that it affects environmental behaviour as well as policy implementation. As Clark (Clark, 1991b) reports

*When the first social purpose is community sustainability, a quite different social ethic emerges. There is a strong sense of sharing-of work, of food, and of decision making. ... the Physical Quality of Life Index soars when communities feel in charge; birth-rates drop and health improves. Nor is it considered "extravagant" to provide free education and to subsidize food prices (in the absence of universal access to jobs or land) as a form of community investment in the next generation... p408*

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122 "... governance discourses on science and technology tend to be mediated by and constrained to wrangles over expert-led analyses of the magnitude, likelihood or distribution of benefits or harm. What is missing are general arenas to enable unconstrained discourse about the orientation of scientific and technological choices. In short, we lack a truly reflective (let alone reflexive) 'politics of technology'. Indeed, the hegemony of Enlightenment vocabularies of progress is so entrenched that we lack even the language to appreciate fully the magnitude of this gaping void in contemporary governance discourses." STIRLING, A. Ibid. Precaution, foresight and sustainability: reflection and reflexivity in the governance of science and technology. p233



The Sustainability Institute (sustainabilityinstitute) suggests that typical benefits from participation include:

- *Building support for high leverage strategies and letting go of ineffectual strategies*
- *More realistic understanding of dynamics and trends*
- *Stitching together research on diverse areas*
- *Motivation to act*
- *Hope and optimism that there are possibilities*
- *Increased teamwork across stakeholder groups — a focus on the system not the individuals. (NP)*

Participation can be regarded merely as doing the right thing (Stirling, 2006) but increasingly it is recognised as being essential to the policy process. An open participatory approach to policy making reflects the level of commitment a government has to public engagement. Governance can facilitate community engagement in an open-ended, uncertain environment.

Participation processes need to be carefully managed. Legitimacy, accountability, salience and efficacy do not automatically follow from opening a process to public engagement or consultation. Participation can slow down the decision-making process so that it seems like nothing ever gets done<sup>123</sup>. Lack of action may exacerbate issues, but, on the other hand, processes that are rushed may actually extend the process when the lack of involvement manifests as community opposition. Although a process may appear to have stalled, it may be that the learning has jumped to another level of comprehension and a different point in the cycle of adaptation. In other words, the linear progression may stall, but the actual process may have shifted to more relevant albeit non-sequential issues: ‘... the learning cycles may appear as a linear series for initial clarity, but implementation may require weaving a far more complex path’ (Sendzimir et al., 2006).

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123 “Complex systems make learning difficult and make ordinary policy design fraught with problems. Often, we don't have time to watch and see if our interventions are going to work well, and then readjust accordingly. ....we need tools plus supporting conversations and processes for learning and designing actions within these complex systems — tools for accelerating our collective learning: systems thinking.” SUSTAINABILITYINSTITUTE Why Use Systems Thinking?

The actual selection of participants and how they may be involved is a critical part of the participation process. Mistakes made in the selection of participants can thwart the learning and adaptation aspects of the process and lead to stalemate. Tàbara and Pahl-Wostl (Tàbara and Pahl-Wostl, 2007) suggest that participation and inclusion helps create common grounds for framing issues, and that a 'shared representation of the issues at stake' is necessary; creating trust between institutions and stakeholders provides a basis for 'critical mutual self-reflection'.

An open and pluralistic decision-making process has functional and instrumental values. Public engagement makes decision-making more transparent, makes policymakers more accountable and helps overcome perceptions of 'government failure' (Rammel et al., 2004) p17. It can create greater trust and thereby improve the legitimacy of decisions and policy outcomes (Stirling, 2006). Participation and learning are mutually beneficial when coordinated and integrated properly (Lafferty, 2004b). Participation adds a diversity of information to the process that augments and challenges scientific perspectives and those presented in the media (Arentsen et al., 2000).

#### *12.2.4.2 Institutional framework for sustainability*

The institutional framework has a critical role in facilitating the creation and dissemination of the sustainability narrative<sup>124</sup>. A responsive institutional framework incorporating integrated and interrelated structures and planning processes is needed to allow adaptive management for the transition to sustainability (Kemp et al., 2005). Stirling (Stirling, 2006) states:

*...the institutional integration of precaution and foresight discourses constitutes a key element in the development of more reflective and reflexive governance for sustainability. p254*

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<sup>124</sup> An institution is defined as a "a relatively stable collection of practices and rules defining appropriate behaviour for specific groups of actors in specific situations" March and Olsen (1998: 948) in LAFFERTY, W. M. (2004b) Governance for sustainable development: lessons and implications. IN LAFFERTY, W. M. (Ed.) *Governance for sustainable development : the challenge of adapting form to function*. Cheltenham, UK ; Northampton, Mass., Edward Elgar.. Poovey POOVEY, M. (2004) For what it's worth. *Critical Inquiry*, 30.2. describes institutions as being forms of representation, as well as "... mediations among representations, behaviors (both personal and social modes of subjectivity), and larger social processes."

Richardson (Richardson, 2002) explains that, as the boundaries between national and international jurisdictions become less distinguishable, different mixes of institutional relationships require a governance approach to accommodate interactions at local, national and transnational scales and the changing relationships between the private and public sector. Sustainability policy requires an institutional framework that is able to address relations within, and between, micro, mesa and macro levels in decision-making processes so that policy is applicable across different scales (Kemp and Loorbach, 2006). It requires structures that can integrate vertical and horizontal systems dynamics across a range of disparate activities, 'governments, sectors and realms of specialty' (O'Toole, 2004) (Pp50-51). Institutional structures need to be iterative to accommodate the various stages of analysis, debate, and negotiation within all the layers in which sustainability issues manifest (O'Connor, 2002).

Kemp and Loorbach (Kemp and Loorbach, 2006) describe how a multi-level approach can create a portfolio of options. Systemic change is often a cascade of sequences: successful change occurs when changes in one domain, or level, filter through to, or interact constructively with developments in other domains.

Loorbach (Loorbach, Undated) describes the interactions between levels:

*At the micro-level it aims at influencing the variation and selection process through creating room for self-organisation, experimentation, learning and knowledge co-production. At the macro-level, transition management aims at redefining leading visions, ambitions and goals within the context of a constantly changing society. At the meso-level, transition management targets existing institutions, regimes and structures in order to 'open them up' or tries to develop new, competing ones. NP*

Institutional design for sustainability needs to consider the appropriateness of the cognitive capacities of policymakers (Arentsen et al., 2000).

Governance makes demands on conventional institutions and policy processes for which they were not designed (Ropke, 1998). Kemp, Parto and Gibson (Kemp et al., 2005) explain that the challenge of transition management is to show how a core set of tools can be developed to facilitate the transition to sustainability-compatible institutions and processes. Bureaucratic institutions focus on standardising procedures and are not change management structures. Sustainability cannot be

imposed; nor can complexity be controlled. The capacity to change needs to be developed and managed as a process of transition.

### **Transition management**

The institutional framework for sustainability policy needs the capacity to provide the transition to sustainability (Kemp and Loorbach, 2006, Rotmans et al., 2001).

Transition management (Loorbach and Rotmans, 2006) provides a valuable approach to implementation as an augmentation and adaptation of existing institutional structures and processes. It is suggested that transition management can be

*...considered as a new form of governance that is aimed at influencing and coordinating the complex societal dynamics in the direction of sustainability or at creating opportunities for a transition to occur. (Loorbach, Undated) NP*

The aims of transition management are to provide a 'portfolio of management strategies' at micro, macro and meso-levels:

*At the micro-level it aims at influencing the variation and selection process through creating room for self-organisation, experimentation, learning and knowledge co- production. At the macro-level, transition management aims at redefining leading visions, ambitions and goals within the context of a constantly changing society. At the meso-level, transition management targets existing institutions, regimes and structures in order to 'open them up' or tries to develop new, competing ones. (Loorbach, Undated) NP*

It is clear that approaches like transition management are much more closely aligned with sustainability-informed perspectives on contemporary issues than are neoclassical economic issues. It follows that finding ways to apply transition management approaches to work with the Sustainability-informed System of National Accounts may bridge the gap between what is conceptually possible and what is deemed practical from the contemporary perspective that is framed by economism. The blend of reconceptualisation and cognitive adaptation with the practical realities of policy processes (visions, strategies, agenda, projects) across various spatial and dynamic frameworks to accommodate the sophisticated interpretations of sustainability issues makes it seem possible and practical. Transition management engages with the issues of bringing these aspects together

to make sustainability policy effective<sup>125</sup>. It embraces the complex reality of the issues and the frameworks policymakers have to work within, rather than foisting abstract ideal type constructs on to policy makers and telling them to make it work.

### 12.2.5 Adaptive management

Adaptive management supports a cyclical framework for policy implementation. Sustainability-informed monitoring is needed to inform the next cycle of decision-making. This may include redesign of policies, or reframing issues and the rules by which decisions are made (Froger and Zyla, 1998).

Sendzimir (Sendzimir et al., 2006) describes the process as a series of six steps in which the continuous cycle of adaptive management is augmented by including varying pathways by which the process may progress with community engagement. The starting point involves identifying where a degree of trust already exists between prospective participants. Identifying and focusing on a sense of place (Seddon, 1972) is a useful tool in this regard.

### Sustainability indicators and assessment

Sustainability requires a cognitive shift away from monodimensional framing of indicators toward transdisciplinary analysis in which multi-criteria are used. Tarrant (Tarrant, 2008) explains that a sustainability report should report on

*... the risks, opportunities and performances of an organisation... It takes time to achieve a degree of sophistication and real performance data ... and the pace of the process is determined by whether or not a company has embraced sustainability as part of its core business. If it has done that, then reporting is simply part of how they do business'. Liza Marmone, Ernst and Young in Tarrant p39*

Gasparatos, El-Haram and Horner (Gasparatos et al., 2009) describe how a variety of assessment tools have been generated in the past decade. As with all effective indicators, sustainability assessment tools

*... must be accurate, robust and based on sound theoretical foundations*

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<sup>125</sup> "At every level, different processes with different dynamics and different sort of output take place (visions, strategies, agenda's, projects). Transition management tries to align these processes through a combination of network- governance and self-steering." LOORBACH, D. & ROTMANS, J. (2006) Managing transitions for sustainable development. IN OLSHOORN, X. & WIECZOREK, A. J. (Eds.) *Understanding industrial transformation: views from different disciplines*. Dordrecht, Springer.

*backed with empirical evidence if misleading policy messages are to be avoided. p246*

There is great emphasis in contemporary policy processes on providing a single indicator of sustainability. Böhringa and Jochem (Böhringera and Jochem, 2007) explain how policy makers are keen to have a single aggregate index that is unambiguous and easy to communicate with the general public. Of course to provide such an indicator requires denying complexity and uncertainty. This is the reason there is need for policy and social learning for sustainability.

Weaver and Rotmans (Weaver and Rotmans, 2006) propose an Integrated Sustainability Assessment (ISA) framework to meet the needs of sustainability policy. They describe it as:

*... a cyclical, participatory process of scoping, envisioning, experimenting, and learning through which a shared interpretation of sustainability for a specific context is developed and applied in an integrated manner in order to explore solutions to persistent problems of unsustainable development. p12*

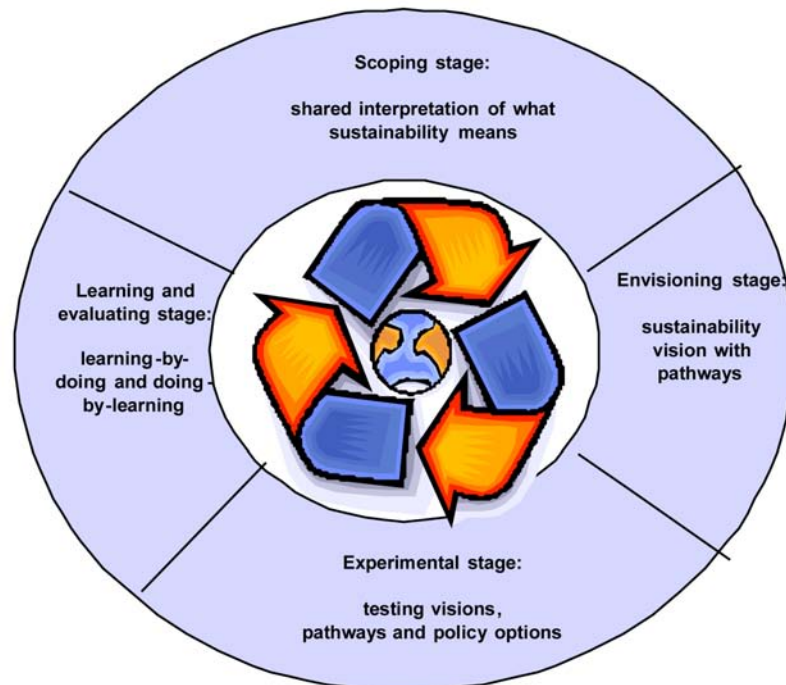


Figure 2: ISA as cyclical process

from 'Integrated Sustainability Assessment: What? Why? How?'  
by Paul M. Weaver and Jan Rotmans  
Matisse Working Papers 1, October, 2006, P 13

The ISA consists of four cyclical stages: scoping, envisioning, experimenting and learning. The envisioning stage involves the development of a vision of a sustainable future for the system of interest. The process depends on a conceptual transformation of sustainability as a *problem* into sustainability as a *challenge*. The *process* of envisioning is therefore at least as important as the vision itself (van Asselt, Rotmans and Rothman, 2005). Weaver suggests that the envisioning process has significant potential for mobilising stakeholders who are involved. Voss and Kemp (Voss and Kemp, 2006) explain that sustainability initiatives need adaptive capacities to

*allow for error and learning .... respond to unexpected effects and developments. Strategies should feature experimentation, monitoring and evaluation so that they may respond systematically to new experiences, altered interpretations and changed circumstances. p18*

### **12.3 Professional reform of economics**

Professional reform is needed to bring the discipline of economics within a broad context of a sustainability-informed approach to policy. This requires acceptance that economics is a subset of sustainability parameters, not the other way round: sustainability is not a subset of economics.

A profound reform is required if the profession of economics is to attain a relevant role in developing and implementing effective sustainability policy. The term 'profession' describes the collegial standards and best practice parameters for an occupation; it is a dynamic term as a profession is characterised by ongoing learning and development of the members of the profession (Poovey, 1998)<sup>126</sup>.

As a discipline sustainability-informed economists need to avoid the use of polynoms, metonyms and hypostatisations that create the illusion of coherence and

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<sup>126</sup> "In 1825, as we have seen, political economists were not professionalized, they did not even agree on the objects or the method of their science, and their hold on an institutional position either within the universities or in relation to government was anything but secure. To recommend such an institutional solution to both the philosophical problem of induction and the controversies sparked by political economy was thus to engage in a certain amount of wishful thinking. Indeed, one might argue that in dividing the functions that Smith, Stewart, and Malthus had assimilated into "political economy" McCulloch was actually recommending to political economists that they discipline themselves, that they form themselves into something resembling the old professions, with their systems of credentialing and self-government." POOVEY, M. (1998) *A history of the modern fact : problems of knowledge in the sciences of wealth and society*, Chicago, University of Chicago Press. Pp304-305

substantiation. Frequently the pathetic fallacy creeps in when economists ascribe attributes to reified abstractions; they talk with a certainty *as if* they know what each other is talking about, but, when pressed, cannot give substantiable answers. Economists 'tend' towards making conclusions. For example, a statement like 'business confidence was below market expectations' is commonly used and generally passes without comment: lack of contesting implies defacto acceptance. We all presume to know what they are talking about. However, an illusion of coherence is created because the pathetic fallacy is so common: there are no such *things* as 'business confidence' or 'market expectations. Both are aggregated abstractions that suffer the pathetic fallacy: abstractions cannot 'have' human traits like confidence or expectations. A more accurate rendition of the statement would be something like 'the index of business confidence was below the expectations of some market analysts'. This statement is more modest and more indicative of what economic analysis can actually explain.

Similarly, the arrogation of issues into an economic framework needs to be seen as a corruptor of analysis: in particular capitalism needs to be rooted out because of its propensity to malframe issues.

Using an historical example, Lavoisier and his chemist colleagues realised that the new chemistry required a new language to separate it from the phlogiston theory and the alchemy tradition. Riskin (Riskin, 2002) describes a lively debate about the origins and appropriateness of language in chemistry. Once again, as Keynes (Keynes, 1973) wrote:

*The difficulty lies, not in the new ideas, but in escaping from the old ones. p27*

The implication is that a revision of the language that is used to frame economic perspectives on complex issues is needed to reflect the biophysical context in which it operates (compared with the ideal-type abstractionist world its current modelling portrays) and to more accurately reflect the perspectives and understandings that are now held in other sciences.

Methodological reform of the economics discipline is needed to better approach (frame) issues as they actually manifest in the real world. Contemporary economic



methodology affects cognition (ways-of-thinking), epistemology (ways-of-knowing) and conation (ways-of-doing) in ways that are incommensurable with sustainability, or create tensions or anomalies. Methodological reform for sustainability means accommodating the complexities, uncertainty and ambiguities of the contemporary global situation, rather than perpetuating an abstract, ideal-type approach to issues in a world of 'as if' assumptions. Invariably, any particular methodology will have inadequacies and biases; ergo: it is important that disciplines have a degree of self-reflection (reflexivity) with respect to the validity of their own parameters, and a degree of commensurability that establishes validity with other disciplines. Methodological reform needs to address the self-referential aspects of neoclassical economics that keep it moribund and untethered from real world to which it purports to apply.

Professional economic organisations can facilitate a move towards a sustainability-informed economics by employing and insisting on methodologies that incorporate reflexive thinking and awareness to move beyond the self-referentialism.

Contemporary abstractionist economic theory needs to root out conjectural abstractions, reifications, hypostatisations, economic lexicalism (creating phrases to describe biophysical reality in terms that suit economic modelling -- e.g. 'natural capital'), excessive quantificationism, and avoiding the pathetic fallacy in the analysis of economic activities. No small task, but one which the revolutionary chemists undertook in the 18<sup>th</sup> century to move beyond alchemy, and one which the Bourbaki (Mashaal, 2006) mathematicians of the 20<sup>th</sup> century undertook to prepare mathematical education for the scientific and computer age.

The use of abstractions and quantification needs to be tempered by qualitative and contextual aspects that are relevant to analysis. Abstractions tend to implicitly simplify, generalise and mask complex causal relations as if they were known, linear and single valued. Abstractionism tends to assume away the very issues that economics is needed to address: prioritisation and relative qualitative values.

Similarly, quantification needs to avoid perpetuating the blind trust in numbers that follows from number-dominant analysis (Porter, 1995). Assigning numbers to

qualitatively different agents or objects of analysis creates false objectivity, and implies that mathematical operations can be performed on numbers even though they originated as signifiers (e.g. indexes), not quantities<sup>127</sup>. The context in which the numbers are assigned, and for what purpose, need to be critically analysed for tacit methodological biases.

#### **12.4 Conclusion**

Many of the elements of a sustainability-informed policy framework already exist. If adopted, the changes suggested in this thesis would provide scope for them to be brought into the mainstream policy process for sustainability. At the moment, the dominance and intransigence of the neoclassical economic methodology and episteme mean that the efficacy of these policy instruments is thwarted, or marginalised if they are not processed with monodimensional QMA techniques. Even if they are presented in monetary prices, they are still marginalised because the methodologies by which non-market goods and services are valued are flawed. It is a no win situation.

The policy framework presented here presents a summary of tools and approaches that can be taken up immediately and begin moving along the pathway to sustainability.

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<sup>127</sup> A telephone number is a signifier, to analyse average telephone numbers, or rank them according to numerical value are extreme examples of invalid application of mathematical operations being misapplied to numbers.



### **Chapter 13: Summary of key contributions and conclusions**

The imperatives for effective sustainability have increased in the years since this research formally began. News abounds of increases in greenhouse gas emissions, reductions in the size of the Great Barrier Reef and dangerous economic brinksmanship. There is still need for ways to make viability sustainable.

This thesis has sought to answer the question:

*How can an economic framework be created to facilitate effective sustainability policy?*

In the course of exploring this question, the following key contributions were developed:

- 1 distinguishing between systemic non-sustainability and behavioural unsustainability so that policymakers can target non-sustainable parameters for the former, and educational strategies for the latter;
- 2 analysing the nexus between sustainability and neoclassical economics to show that there is the dissonance and dysfunctionality and, therefore that a choice between paradigms needs to be made for the framing of sustainability policy;
- 3 describing the inadequacy and inappropriateness of neoclassical economics as a sustainability policy paradigm, and recognising that the dominance and intransigence of the neoclassical economic episteme needs to be considered when developing a change process to move towards sustainability;
- 4 describing the myopia of neoclassical economics that focuses solely on pricing issues of market failure and ignores the creation of purchasing power and the role it plays in market functioning;
- 5 exposing the process of arrogation by which sustainability is interpreted as an essentially economic issue; exposing the propensity to frame the world as consisting of various forms of capital; describing the malframing of issues and malpolicy that arise from the simplistic analysis and arrogation;

- 6 describing economism and the tragedy of economism that results from ongoing use of an outmoded paradigm;
- 7 demonstrating the need to move accounting away from quantification - monetisation-aggregation methodologies in order to recalibrate economic activities within a sustainability-informed accounting taxonomy with categories that accommodate pluralist, dynamic, iterative and qualitative aspects.
- 8 reframing sustainability within a complex adaptive systems approach and reconceptualising economics within a sustainability-informed ontology (e.g. reclaiming economics from *chrematistics* to a focus on *oeconomie* – management of the global household);
- 9 creating a Viability Analysis framework using a fluid dynamics approach that focuses on transdisciplinary multidimensional analysis of viability constructs within biophysical and abstract (socio-cultural) domains, as well as the interface between the two domains;
- 10 reconceptualising the national accounts as a multi-dimensional narrative framed within a sustainability-informed ontology to incorporate multidimensional metaproperties needed to account for complex issues;
- 11 describing a sustainability-informed policy framework based on parameters, principles, perspective and processes – including governance – that are compatible with an enduring life supporting planet;
- 12 demonstrating that it is possible to reframe the relationship between sustainability and economics through conceptual, cognitive, ontological and epistemological change so that viability can be sustainable.

The most substantive original contribution relates to point 11, the proposal for the development of a sustainability-informed system of national accounts (SISNA). My conclusions about the SISNA are:

1. The existing ATO Business Industry Codes is a potentially effective sustainability policy framework and implementation tool: it exists; it could

be readily re-structured according to sustainability criteria to create a sustainability-informed ontological taxonomy that facilitates ongoing learning, iterative policy processes and qualitative input into economic data bases.

2. The proposed sustainability-informed system of national accounts (SISNA) overcomes the constraints and methodological contortions required by quantification and aggregation of disparate entities with immeasurable attributes and functions that, nevertheless, are relevant to sustainability policy processes.
3. A SISNA accommodates and integrates qualitative data into the policy making processes in a manner that is commensurable and respectful of the ontologies, cognitive underpinnings, methodologies and epistemologies of sciences other than economics.
4. A SISNA facilitates the creation and development of a robust sustainability narrative that is needed for sustainability parameters to be accepted by and integrated into the broader cultural narrative, much as public health policies have been integrated into the cultural milieu. The sustainability narrative can help regain integrity, control and validity to national currency systems.
5. A SISNA facilitates ongoing learning processes that are needed for approaching complex issues that underpin sustainability policy.
6. A SISNA will enhance the efficacy of existing SNA reforms and satellite accounts by providing scope for them to be integrated into central national accounting processes, rather than being marginalised.
7. The combination of the need for modelling in the Viability Analysis framework, the reclaiming and reforming of professional economics from neoclassical economics constraints, and the ongoing development and refinement of sustainability-informed meta data within the SISNA structure will provide enormous research opportunities for economists and researchers willing to undertake the sustainability policy challenge.



## References

- ABRAHAM, K. G. & MACKIE, C. (Eds.) (2005) *Beyond the Market: Designing Nonmarket Accounts for the United States*, Panel to Study the Design of Nonmarket Accounts, National Research Council.
- ABRAHAM, K. G. & MACKIE, C. (2006) A Framework for Nonmarket Accounting. *National Bureau of Economic Research, A New Architecture for the U.S. National Accounts*, 161-193.
- ACKERMAN, F. (2004a) Existence values and priceless externalities. IN ACKERMAN, F. (Ed.) *The flawed foundations of general equilibrium : critical essays on economic theory*. London ; New York, Routledge.
- ACKERMAN, F. (2004b) *The flawed foundations of general equilibrium : critical essays on economic theory*, London ; New York, Routledge.
- ACKERMAN, F. & HEINZERLING, L. (2004) *Priceless : on knowing the price of everything and the value of nothing*, New York, New Press.
- ACKERMAN, M. (2003) What Does 'Natural Capital' Do? The Role of Metaphor in Economic Understanding of the Environment. *Environmental Values*, 12, 431-448.
- ALCAMO, J., BENNETT, E. M. & MILLENNIUM ECOSYSTEM ASSESSMENT (PROGRAM) (2003) *Ecosystems and human well-being : a framework for assessment*, Washington, DC, Island Press.
- ALCOFF, L. (1998) *Epistemology : the big questions*, Malden, MA, Blackwell Publishers.
- ANDERSEN, H., BARKER, P. & CHEN, X. (2006) *The Cognitive Structure of Scientific Revolutions*. Cambridge, Cambridge University Press.
- ANDERSSON, T., FOLKE, C. & NYSTRÖM, S. (1995) *Trading with the environment : ecology, economics, institutions and policy*, London, Earthscan.
- ANDREWS, R. N. L., DARNALL, N. & GALLAGHER, D. R. (1999a) Environmental Management Systems: A Sustainable Strategy for a Sustainable World? *Eighth International Conference of the Greening of Industry Network, "Sustainability: Ways of Knowing, Ways of Acting*. Kenan-Flagler Business School, University of North Carolina at Chapel Hill, University of North Carolina at Chapel Hill
- ANDREWS, R. N. L., DARNALL, N., GALLAGHER, D. R. & VILLANI, J. (1999b) The Effects of ISO 14001 Environmental Management Systems on the Environmental and Economic Performance of Organizations *National Database on Environmental Management Systems*. Chapel Hill, University of North Carolina at Chapel Hill.
- ANIELSKI, M. (2000) Fertile Obfuscations: Making Money Whilst Eroding Living Capital. *34th Annual Conference of the Canadian Economics Association*. University of British Columbia, Vancouver.



- ARENTSEN, M. J., BRESSERS, H. T. A. & O'TOOLE, L. J. (2000) Institutional and policy responses to uncertainty in environmental policy: A comparison of Dutch and U.S. styles. *Policy Studies Journal*, 28.
- ARIANRHOD, R. (2005) *Einstein's Heroes: Imagining the World Through the Language of Mathematics*, New York, Oxford University Press.
- ARROW, K. J. (1972) General Economic Equilibrium: Purpose, Analytic Techniques, Collective Choice. *Nobel Memorial Lecture, December 12, 1972*.
- ARROW, S. K. (1951) *Social Choices and Individual Values*, Yale University Press.
- ASSELT, M. B. A. V. (2000) *Perspectives on uncertainty and risk : the PRIMA approach to decision support*, Boston, Kluwer Academic Publishers.
- ASSELT, M. B. A. V., ROTMANS, J., ELZEN, M. D. & HBM, H. (1995) Uncertainty in integrated assessment modelling: a cultural perspective based approach. *Global Dynamics & Sustainable Development Programme*. Bilthoven, the Netherlands, National Institute of Public Health and the Environment (RIVM).
- ASTLEITHNER, F., HAMEDINGER, A. & HOLMAN, N. (2004) Institutions and indicators – The discourse about indicators in the context of sustainability. *Journal of Housing and the Built Environment*, 19, 7-24.
- AUSTRALIAN BUREAU OF STATISTICS (2009) Linking the environment and economy: Towards an integrated environmental-economic account for Australia.
- AUSTRALIAN GOVERNMENT TAXATION OFFICE (2005) Business Industry Codes. Canberra.
- AYRES, R. U. (2001) The need for a new growth paradigm. IN COSTANZA, R., CLEVELAND, C. J., STERN, D. I. & ECONOMICS., I. S. F. E. (Eds.) *The economics of nature and the nature of economics*. Cheltenham, Edward Elgar.
- BACKHOUSE, R. E. (1994) *New Directions in Economic Methodology*, London ; New York, Routledge.
- BARBIER, E. B., BURGESS, J. C. & FOLKE, C. (1994) *Paradise Lost? The Ecological Economics of Biodiversity*, London, Earthscan.
- BARSALOU, L. W. (1992) Frames, Concepts and Conceptual Fields. IN LEHRER, A. & KITTAY, E. F. (Eds.) *FRAMES, FIELDS, AND CONTRASTS: New Essays in Semantic and Lexical Organization*. Hillsdale, New Jersey, Erlbaum.
- BARSALOU, L. W. (1993) Flexibility, Structure, and Linguistic Vagary in Concepts: Manifestations of a Compositional System of Perceptual Symbols. IN COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. & MORRIS, P. E. (Eds.) *Theories of Memory*. Hillsdale, New Jersey, Erlbaum.
- BARTHES, R. (1973) *Mythologies*, Frogmore, Eng., Paladin.
- BARTON, A. D. (1975) *The Anatomy of Accounting*, St Lucia, Queensland, University of Queensland Press.
- BATESON, G. (1987) *Steps to an ecology of mind : collected essays in anthropology, psychiatry, evolution and epistemology*, Northvale, N.J, Aronson.

- BECK, U. (2006) Reflexive governance: politics in the global risk society. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- BECKER, G. S. (1981) *A treatise on the family*, Cambridge, Mass., Harvard University Press.
- BELL, S. & MORSE, S. (2003) *Measuring sustainability : learning by doing*, London ; Sterling, VA, Earthscan Publications Ltd.
- BELTRATTI, A. (1996) *Models of economic growth with environmental assets*, Dordrecht ; Boston, Kluwer Academic.
- BERMEJO, J. (2007) A Simplified Guide to Create an Ontology. *The Autonomous Systems Laboratory*. Madrid, UNIVERSIDAD POLITECNICA DE MADRID.
- BERTUGLIA, C. S. & VAIO, F. (2005) *Nonlinearity, chaos, and complexity : the dynamics of natural and social systems*, Oxford ; New York, Oxford University Press.
- BERZ, G. A. (1999) Catastrophes and Climate Change: Concerns and Possible Countermeasures of the Insurance Industry. *Mitigation and Adaptation Strategies for Global Change*, 4, 283-293.
- BLAUG, M. (1997) *Economic theory in retrospect*, Cambridge ; New York, Cambridge University Press.
- BLIGHT, S. & BURKE, G. (2009) Sustainability and Economism Interaction. Rangs Graphics.
- BOETTKE, P. J., COYNE, C. J. & LEESON, P. T. High Priests and Lowly Philosophers: The Battle for the Soul of Economics. Department of Economics, George Mason University, Virginia, USA.
- BOHLEN, C. C. (1996) Economics and the Environment. *Ecology*, 77, 1644.
- BÖHRINGERA, C. & JOCHEM, P. E. P. (2007) Measuring the immeasurable — A survey of sustainability indices. *Ecological Economics*, 63, 1-8.
- BOUMANS, M. (2001) Measure for Measure: How Economists Model the World into Numbers. *Social Research*, 68, 427-453.
- BOURDIEU, P. (2005) *The social structures of the economy*, Cambridge, UK ; Malden, MA, Polity.
- BOVENS, M. A. P., HART, P. T. & PETERS, B. G. (2001) Analysing governance success and failure in six European states. IN BOVENS, M. A. P., HART, P. T. & PETERS, B. G. (Eds.) *Success and failure in public governance : a comparative analysis*. Cheltenham, UK, Edward Elgar.
- BRADBURY, J. & RAYNER, S. (2002) Reconciling the irreconcilable. IN ABAZA, H. & BARANZINI, A. (Eds.) *Implementing sustainable development : integrated assessment and participatory decision-making processes*. Cheltenham, UK ; Northampton, MA, E. Elgar, for and on behalf of UNEP.
- BRADY, J. (2005) *Environmental management in organizations : the IEMA handbook*, London ; Sterling, Va., Earthscan.

- BRANTLINGER, P. (1996) *Fictions of state : culture and credit in Britain, 1694-1994*, Ithaca, Cornell University Press.
- BRESSERS, H. & ROSENBAUM, W. A. (2003) Social Scales, Sustainability and Governance: An Introduction. IN ROSENBAUM, W. A. & BRESSERS, H. (Eds.) *Achieving sustainable development : the challenge of governance across social scales*. Westport, Conn., Praeger.
- BRESSERS, H. T. A. (2004) Implementing sustainable development: how to know what works, where, when and how. IN LAFFERTY, W. M. (Ed.) *Governance for sustainable development : the challenge of adapting form to function*. Cheltenham, UK ; Northampton, Mass., Edward Elgar.
- BRESSERS, H. T. A. & ROSENBAUM, W. A. (2000) Innovation, learning, and environmental policy: Overcoming "a plague of uncertainties". *Policy Studies Journal*, 28, 523-539.
- BROHMAN, J. (1995) Economism and critical silences in development studies: a theoretical critique of neoliberalism. *Third World Quarterly*.
- BROMLEY, D. W. (2007) Environmental regulations and the problem of sustainability: Moving beyond "market failure". *Ecological Economics*, 63, 676-683.
- BROWN, J. & FRAME, B. (2005) Democratizing Accounting Technologies: Theh Potential of the Sustainability Assessment Model (SAM). *Working Paper Series*. Wellington, Centre for Accounting, Governance and Taxation Research.
- BROWN, M. L. (2000) Scientific uncertainty and learning in European union environmental policymaking. *Policy Studies Journal*, 28, 576-596.
- BRUNDTLAND, G. H. & WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT. (1990) *Our common future*, Melbourne, Oxford University Press.
- BUCHANAN, M. (2000) *Ubiquity: The Science of History*, London, Wiedenfield & Nicolson.
- BURKE, G. (1991) *The economic and political factors affecting the viability of farmland restoration in the Great Southern Region of Western Australia : a historical perspective on the British economic paradigm*.
- BURKE, G. (1996) *More than pests : the strategic significance of feral animals and invasive plants for nature conservation and landcare in Western Australia*, Murdoch, W.A., Institute for Science and Technology Policy, Murdoch University.
- BURMEISTER, E. (2000) The Capital Theory Controversy. IN KURZ, H. D. (Ed.) *Critical Essays on Piero Sraffa's Legacy in Economics*. Cambridge, Cambridge University Press.
- BURRITT, R. (2005) Challenges for Environmental Management Accounting. IN RIKHARDSSON, P. M., BENNETT, M., BOUMA, J. J. & SCHALTEGGER, S. (Eds.) *Implementing environmental management accounting : status and challenges*. Dordrecht, Springer.

- BURTT, E. A. (1932) *The metaphysical foundations of modern physical science : a historical and critical essay*, London, Routledge & K. Paul.
- CAIRNCROSS, F. (1992) *Costing the earth : the challenge for governments, the opportunities for business*, Boston, Mass, Harvard Business School Press.
- CAMPBELL, J. (1973) *The masks of God*, London, Souvenir Press (Educational & Academic).
- CHRISTENSEN, P. P. (2001) Early links between sciences of nature and economics: historical perspectives for ecological and social economics. IN COSTANZA, R., CLEVELAND, C. J., STERN, D. I. & ECONOMICS., I. S. F. E. (Eds.) *The economics of nature and the nature of economics*. Cheltenham, Edward Elgar.
- CLARK, C. W. (1991a) Economic Biases Against Sustainable Development. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.
- CLARK, M. E. (1991b) Rethinking Ecological and Economic Education: A Gestalt Shift. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.
- CLARK, M. E. (2002) *In Search of Human Nature*, London, Routledge.
- COBB, C. W. & DOUGLAS, P. H. (1928) A Theory of Production. *American Economic Review*, 18 (Supplement), 139-165.
- CODDINGTON, A. (1983) *Keynesian economics : the search for first principles*, London, Allen & Unwin.
- CONANT, J. B. (1967) *The overthrow of the phlogiston theory : the chemical revolution of 1775-1789*, Harvard U.P.
- CONKLIN, J. (2006) *Dialogue Mapping: Building Shared Understanding of Wicked Problems*, Wiley.
- CONNOR, R. & DOVERS, S. (2004) *Institutional change for sustainable development*, Cheltenham, U.K. ; Northampton, Mass., Edward Elgar.
- COOPER, P. J. & VARGAS, C. M. (2004) *Implementing sustainable development : from global policy to local action*, Lanham, Md., Rowman & Littlefield Publishers.
- COSTANZA, R. (2001) *Institutions, ecosystems, and sustainability*, Boca Raton, Lewis Publishers.
- CLEVELAND, C. J., STERN, D. I. & COSTANZA, R. (2001a) *The economics of nature and the nature of economics*, Cheltenham, Edward Elgar.
- COSTANZA, R., FARBER, S., CASTENADA, B. & GRASSO, M. (2001b) Green national accounting: goals and methods. IN COSTANZA, R., CLEVELAND, C. J., STERN, D. I. & ECONOMICS., I. S. F. E. (Eds.) *The economics of nature and the nature of economics*. Cheltenham, Edward Elgar.
- COSTANZA, R. & WAINGER, L. (1991) *Ecological economics : the science and management of sustainability*, New York, Columbia University Press.

- CROSBY, A. W. (1997) *The measure of reality : quantification and Western society, 1250-1600*, Cambridge ; New York, Cambridge University Press.
- CUMBERLAND, J. H. (1991) Intergenerational Transfers and Ecological Sustainability. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.
- DALY, H. E. (1971) The Steady State Economy: Toward a Political Economy of Biophysical Equilibrium and Moral Growth. *University of Alabama "Distinguished Lecture Series, No 2*. University of Alabama.
- DAVIS, L. (1994) Genetic Algorithms and Financial Applications. IN DEBOECK, G. J. (Ed.) *Trading on the edge: Neural, Genetic and Fuzzy Systems for Chaotic Financial Markets*. New York, John Wiley & Sons.
- DAVIS, M. (2008) *The land of plenty : Australia in the 2000s*, Carlton, Vic., Melbourne University Press.
- DE GREENE, K. B. (1993a) Field-theoretic Framework for Systems Theory and Systems Thinking. IN DE GREENE, K. B. (Ed.) *A Systems-based approach to policymaking*. Boston, Kluwer Academic Publishers.
- DE GREENE, K. B. (1993b) Policy Challenges in a World of Nonlinearity and Structural Change. IN DE GREENE, K. B. (Ed.) *A Systems-based approach to policymaking*. Boston, Kluwer Academic Publishers.
- DEBREU, G. (1991) The Mathematization of Economic Theory. *American Economic Review*, 81, 1-7.
- DENNING, G. (1992) *Mr Bligh's Bad Language: Passion, Power and Theatre on the Bounty*, Cambridge, Cambridge University Press.
- DIAMOND, J. M. (2005) *Collapse : how societies choose to fail or succeed*, New York, Viking.
- DOMAR, E. D. (1947) Expansion and Employment. *American Economic Review*, 37, 34-55.
- DOVERS, S. (2001) *Institutions for sustainability*, Fitzroy, Vic., Australian Conservation Foundation.
- DOVERS, S. (2003a) A policy orientation as integrative strategy. IN YOUNG, M. D., DOVERS, S. & STERN, D. I. (Eds.) *New dimensions in ecological economics : integrated approaches to people and nature*. Cheltenham, UK Northampton, Mass., USA, E. Elgar Pub.
- DOVERS, S. (2003b) Scaling governance and institutions for sustainability. *Paper for the Academic Forum, Network of Regional Government for Sustainable Development (nrg4SD), Regional Governance for Sustainability*. Fremantle, Western Australia.
- DOVERS, S. (2005a) Clarifying the Imperative of Integration Research for Sustainable Environmental Management. *Journal of Research Practice*, 1.
- DOVERS, S. (2005b) *Environment and sustainability policy : creation, implementation, evaluation*, Annandale, N.S.W., Federation Press.

- DOVERS, S. & CONNOR, R. (2006) Institutional and Policy Change for Sustainability. IN RICHARDSON, B. J. & WOOD, S. (Eds.) *Environmental law for sustainability : a reader*. Oxford, Hart Pub.
- DOVERS, S. & HANDMER, J. W. (1997) Contradictions in Sustainability.
- DOVERS, S. & MARSDEN, S. (2002) *Strategic environmental assessment in Australasia*, Annandale, N.S.W., Federation Press.
- DOVERS, S. & Wild River, S. (2003) Institutions for sustainable development. Sydney, ANU.
- DOVERS, S. R., NORTON, T. & HANDMER, J. W. (2001a) *Ecology, uncertainty and policy : managing ecosystems for sustainability*, New York, Pearson Education.
- DOVERS, S. R., NORTON, T. & HANDMER, J. W. (2001b) Ignorance, uncertainty and ecology: key themes. IN HANDMER, J. W., NORTON, T. & DOVERS, S. R. (Eds.) *Ecology, uncertainty and policy : managing ecosystems for sustainability*. New York, Pearson Education.
- DUMAS, L. J. (1986) *The overburdened economy : uncovering the causes of chronic unemployment, inflation, and national decline*, Berkeley, University of California Press.
- DURANT, R. F., O'LEARY, R. & FIORINO, D. J. (2004) Introduction, Environmental governance reconsidered : challenges, choices, and opportunities. IN DURANT, R. F., FIORINO, D. J. & O'LEARY, R. (Eds.) *Environmental governance reconsidered : challenges, choices, and opportunities*. Cambridge, Mass. ; London, MIT Press.
- EARL, P. E. & MAY, N. M. (1992) How Economists can Accept Shackle's Critique of Economic Doctrines without Arguing Themselves out of their Jobs. IN BLAUG, M. (Ed.) *Joan Robinson (1903-1983) and George Shackle (1903-1992)*. Aldershot, England, E. Elgar Pub. Co.
- EDWARDS, A. J. (2004) *ISO 14001 environmental certification step-by-step*, Amsterdam ; Oxford, Elsevier Butterworth-Heinemann.
- ELTIS, D. (1987) *Economic Growth and the Ending of the Transatlantic Slave Trade*, New York, Oxford University Press.
- EMBRECHTS, M. (1994) Basic Concepts of Nonlinear Dynamics and Chaos Theory. IN DEBOECK, G. J. (Ed.) *Trading on the edge: Neural, Genetic and Fuzzy Systems for Chaotic Financial Markets*. New York, John Wiley & Sons.
- ESPINOSA, A. & WALKER, J. (2011) *A Complexity Approach to Sustainability*, London, Imperial College Press.
- EXECUTIVE MANAGER, A. A. A. R. (2010) Standard Economic Values Guidelines, Version 3.0.
- FLANNERY, T. F. (1994) *The Future Eaters: An Ecological History of the Australasian Lands and People*, Chatswood, NSW, Reed Books.

- FOLKE, C. & KABERGER, T. (1991) *Linking the natural environment and the economy : essays from the Eco-Eco Group*, Dordrecht, Boston : Kluwer Academic Publishers.
- FRAME, B. & O'CONNOR, M. (2011) Integrating valuation and deliberation: the purposes of sustainability assessment. *Environmental Science & Policy*, 14, 1-10.
- FROGER, G. & ZYLA, E. (1998) Towards a Decision-Making Framework to Address Sustainable Development Issues. IN O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (Eds.) *Sustainable development : concepts, rationalities, and strategies*. Dordrecht ; Boston, Kluwer.
- FROW, J. (1992) Rationalization and the Public Sphere. *Meanjin*, 3, 505.
- FUNTOWICZ, S. O., MARTINEZ-ALIER, J., MUNDA, G. & RAVETZ, J. (2002) Multicriteria-based environmental policy. IN ABAZA, H. & BARANZINI, A. (Eds.) *Implementing sustainable development : integrated assessment and participatory decision-making processes*. Cheltenham, UK ; Northampton, MA, E. Elgar, for and on behalf of UNEP.
- FUNTOWICZ, S. O. & RAVETZ, J. R. (1991) A New Scientific Methodology for Global Environmental Issues. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.
- GALLOPIN, G. C. (2003) A systems approach to sustainability and sustainable development. Santiago, Chile, United Nations Publication.
- GALLOPIN, G. C. (2007) Linkages between vulnerability, resilience, and adaptive capacity. Potsdam, Potsdam Institute for Climate Impact Research.
- GALLOPIN, G. C., FUNTOWICZ, S. O., O'CONNOR, M. & RAVETZ, J. R. (2001) Science for the twenty-first century: from social contract to the scientific core. *International Journal Social Science*, 168, 219-229.
- GARNAUT (2008) Garnaut Climate Change Review: Interim Report to the Commonwealth, State and Territory Governments of Australia. Canberra, Australian Government.
- GASPARATOS, A., EL-HARAM, M. & HORNER, M. (2009) The argument against a reductionist approach for measuring sustainable development performance and the need for methodological pluralism. *Accounting Forum*, 33, 245-256.
- GEORGESCU-ROEGEN, N., MAYUMI, K. & GOWDY, J. M. (1999) *Bioeconomics and sustainability : essays in honor of Nicholas Georgescu-Roegen*, Cheltenham, UK ; Northampton, MA, USA, E. Elgar.
- GIBSON, R. B. & HASSAN, S. (2005) *Sustainability assessment : criteria and processes*, London ; Sterling, Va., Earthscan.
- GIRIDHARADAS, A. (2009) Are Metrics Blinding Our Perception. *The New York Times*. New York, New York Times.
- GLEESON, J. (1999) *The Moneymaker*, Sydney, Bantam.

- GLEESON-WHITE, J. (2011) *Double Entry: How the merchants of Venice shaped the modern world – and how their invention could make or break the planet*, Sydney, Allen & Unwin.
- GLEICK, J. (1988) *Chaos : making a new science*, London, Heinemann.
- GOLDMAN, A. I. (1986) *Epistemology and cognition*, Cambridge, Mass., Harvard U.P.
- GOODWIN, B. (1994) *How the Leopard Changed its Spots: The Evolution of Complexity*, London, Phoenix.
- GOODWIN, N. R. (1991) *Social Economics: An Alternative Theory*, St. Martin's Press.
- GOWDY, J. M. (1999) Hierarchies in Human Affairs: Microfoundations and Environmental Sustainability. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar.
- GOWDY, J. M. & ERIKSON, J. (2004) Ecological Economics at a Crossroads. *Rensselaer Working Papers in Economics*.
- GRIN, J. (2006) Reflexive modernisation as a governance issue, or: designing and shaping re-structuration. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- GRIN, J., ROTMANS, J. & SCHOT, J. (2011) *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*, London, Routledge.
- HAMILTON, C. (1993) The Limits to Environmental Economics. *Environmental Economics Conference*. Canberra, 1993.
- HAMILTON, C. (1998a) Economic growth and social decline: How our measures of prosperity are taking us down the wrong path. The Australia Institute.
- HAMILTON, C. (1998b) Using Economics to Protect the Environment. *The Roby Lecture*. Murdoch University, 1998.
- HAMILTON, C. & DENNISS, R. (2005) *Affluenza : when too much is never enough*, Crows Nest, N.S.W., Allen & Unwin.
- HAMILTON, K. & RUTA, G. (2006) *Measuring Social Welfare and Sustainability*, World Bank.
- HAMPTON, J. A. (1999) Concepts. IN KEIL, F. C. & WILSON, R. A. (Eds.) *The MIT encyclopedia of the cognitive sciences*. Cambridge, Mass., MIT Press.
- HARPER, HASTIE, ATKINS & MOORE, N. J. (1904) W.A. Royal Commission on Forestry Final Report. Government Printer, 1904 (400 copies) Pp 10-14.
- HARRIS, G. P. (2007) *Seeking sustainability in an age of complexity*, Cambridge, Cambridge University Press.
- HARROD, R. F. (1959) Domar and Dynamic Economics. *Economic Journal*, 69, 451-464.
- HART, K. (2001) *Money in an unequal world : Keith Hart and his memory bank*, New York ; London, Texere.



- HARTZOG, P. B. (2011) *21st Century Governance as a Complex Adaptive System*.
- HASSAN, K. & LEWIS, M. (2007) *Handbook of Islamic banking*, Cheltenham, UK ; Northampton, MA, USA, Edward Elgar.
- HECHT, J. E. E. (2012) *National Environmental Accounting: Bridging the Gap between Ecology and Economy*, Hoboken, RFF Press.
- HEISENBERG, W. (1958) *Physics and philosophy : the revolution in modern science*, London, Allen & Unwin.
- HELLER, J. (1961) *Catch-22*, London, Transworld Pub.
- HENDERSON, W. (1994) *Economics as literature*, London ; New York, Routledge.
- HEYNE, P. (1993) Reaching for heaven on earth: The theological meaning of economics, By Robert H. Nelson. *Journal of Economic Literature*, XXXI, 231-232.
- HILL, M. J. & HUPE, P. L. (2002) *Implementing public policy : governance in theory and practice*, London, Sage.
- HOBERMAN, S. (2008) Ontology and Taxonomy. *Information Management*.
- HOLLING, C. S. (1978) *Adaptive environmental assessment and management*, Chichester ; Brisbane, Wiley.
- HOLMES, R. (2008) *The Age of Wonder: How the Romantic Generation Discovered the Beauty and Terror of Science*, London, Harper Press.
- HORN, R. E. (2001) Knowledge Mapping for Complex Social Messes. *Foundations in the Knowledge Economy*. David and Lucille Packard Foundation, Stanford University.
- HUITT, W. (1999) Conation as an important factor of mind. *Educational Psychology Interactive*. Valdosta, Georgia, Valdosta State University.
- ILLGE, L. & SCHWARZE, R. (2009) A matter of opinion – How ecological and neoclassical environmental economists think about sustainability and economics. *Ecological Economics*, 68, 594-604.
- INGLIS, B. (1981) *The Diseases of Civilization: Why we need a new approach to medical treatment*, Granada, London.
- JACKSON, T., SUZUKI, D., DALY, H., SPETH, G., SIMMS, A., GEORGE, S. & SOPER, K. (2008) The Folly of Growth: How to stop the economy killing the planet. *New Scientist*. London, Sunita Harrington.
- JACOBS, M. (1999) Sustainable Development as a Contested Concept. IN DOBSON, A. P. (Ed.) *Fairness and futurity : essays on environmental sustainability and social justice*. Oxford ; New York, Oxford University Press.
- JANICKE, M. & JORGENS, H. (2000) Strategic environmental planning and uncertainty: A cross-national comparison of green plans in industrialized countries. *Policy Studies Journal*, 28, 612-632.
- JOHNSON, S. (2009) *The Invention of Air*, London, Penguin.

- JORDAN, A., WURZEL, R. K. W. & ZITO, A. R. (2003) 'New' Instruments of Environmental Governance: Patterns and Pathways of Change
- KALDOR, N. & MIRRLEES, J. (1962) A New Model of Economic Growth. *The Review of Economic Studies*, 29, 174-192.
- KANE, M. (1999) Sustainability Concepts: From Theory to Practice. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar.
- KASTENBERG, W. E., HAUSER-KASTENBERG, G. & NORRIS, D. (2005) A New Way of Thinking about Sustainability, Risk and Environmental Decision-Making. IN KOPP, H., SCHROEDER, E. D. & WILDERER, P. A. (Eds.) *Global sustainability : the impact of local cultures : a new perspective for science and engineering, economics and politics*. Weinheim [Germany], Wiley-VCH.
- KELLERT, S. R. & BORMANN, F. H. (1991) Closing the Circle: Weaving Strands Among Ecology, Economics and Ethics. IN BORMANN, F. H. & KELLERT, S. R. (Eds.) *Ecology, economics, ethics : the broken circle*. New Haven, Yale University Press.
- KELLY, K. (2011) Bootstrapping Complexity: Learning from self-organizing systems in nature and technology. IN LLOYD, A. (Ed., Kevin Kelly Pacifica, CA.
- KEMP, R. & LOORBACH, D. (2006) Transition Management: a reflexive governance approach. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- KEMP, R., PARTO, S. A. & GIBSON, R. B. (2005) Governance for sustainable development: moving from theory to practice. *Int. J. Sustainable Development*, 8, 12–30.
- KENNEDY, D., STOCKER, L. & BURKE, G. (2010) Australian local government action on climate change adaptation: some critical reflections to assist decision-making. *Local Environment*, 15, 805-816.
- KETTELL, B. (2010) *Frequently asked questions in Islamic finance*, Hoboken, N.J., Wiley.
- KEYNES, J. M. (1973) *The general theory of employment, interest and money*, London, Macmillan for the Royal Economic Society.
- KIEL, L. D. & ELLIOTT, E. W. (1996) *Chaos theory in the social sciences : foundations and applications*, Ann Arbor, MI, University of Michigan Press.
- KIM, J. C. S. (1994) *The art of creative critical thinking*, Lanham, Md., University Press of America.
- KLAVER, C. C. (2003) *A/moral economics : classical political economy and cultural authority in nineteenth-century England*, Columbus, Ohio State University Press.
- KNETSCH, J. L. (1994) Environmental Valuation: Some Problems of Wrong Questions and Misleading Answers. *Environmental Values*, 3, 351-368.
- KNOX, A. D. (1952) The Acceleration Principle and the Theory of Investment: A Survey. *Economica*, 19, 269-297.

- KOHN, J. (1999a) *Sustainability in question : the search for a conceptual framework*, Cheltenham, Elgar.
- KOHN, J. (1999b) System Hierarchy, Change and Sustainability. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar.
- KOHN, J., GOWDY, J. M., HINTERBERGER, F. & VAN DER STRAATEN, J. (1999a) The Imperative of Sustainability: Introduction. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar.
- KOHN, J., GOWDY, J. M., HINTERBERGER, F. & VAN DER STRAATEN, J. (1999b) Sustainability in Question: Preface. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar.
- KOPP, H., SCHROEDER, E. D. & WILDERER, P. A. (2005) *Global sustainability : the impact of local cultures : a new perspective for science and engineering, economics and politics*, Weinheim [Germany], Wiley-VCH.
- KORTEN, D. (2009) Cultural Trance.
- KRUGMAN, P. (2010) Building a Green Economy. *The New York Times*. New York, New York Times.
- KUDELKA, J. (2008) No longer our problem. *The Australian*. Sydney, New Limited.
- KUHN, T. S. (1970) *The Structure of Scientific Revolutions*, London, University of Chicago Press.
- KUHN, T. S. (1987) What Are Scientific Revolutions. IN KRUGER, L., DASTON, L. & HEIDELBERGER, M. (Eds.) *The probabilistic revolution*. Cambridge, Mass, MIT Press.
- LABUSCHAGNE, C., BRENT, A. C. & VAN ERCK, R. P. G. (2007) Assessing the sustainability performances of industries. *openUP*. Pretoria, South Africa.
- LAFFERTY, W. M. (2004a) *Governance for sustainable development : the challenge of adapting form to function*, Cheltenham, UK ; Northampton, Mass., Edward Elgar.
- LAFFERTY, W. M. (2004b) Governance for sustainable development: lessons and implications. IN LAFFERTY, W. M. (Ed.) *Governance for sustainable development : the challenge of adapting form to function*. Cheltenham, UK ; Northampton, Mass., Edward Elgar.
- LAFFERTY, W. M. (2004c) Introduction: form and function in governance for sustainable development. IN LAFFERTY, W. M. (Ed.) *Governance for sustainable development : the challenge of adapting form to function*. Cheltenham, UK ; Northampton, Mass., Edward Elgar.
- LAFFERTY, W. M. & MEADOWCROFT, J. (2000) Concluding Perspectives. IN LAFFERTY, W. M. & MEADOWCROFT, J. (Eds.) *Implementing sustainable development : strategies and initiatives in high consumption societies*. Oxford, Oxford University Press.
- LANDEFELD, J. S. (2000) GDP: One of the Great Inventions of the 20th Century. *Survey of Current Business*, 6-14.

- LANDEFELD, S., FRAUMENI, B. M. & VOJTECH, C. M. (Undated) Accounting for Nonmarket Production: A Prototype Satellite Account Using the American Time Use Survey
- LAVOISIER, A. (1790) *Elements of Chemistry*, Edinburgh, Dover facsimile edition (1965).
- LEBARON, M. (2003) Cultural and Worldview Frames. IN BURGESS, G. & BURGESS, H. (Eds.) *Beyond Intractability*. Boulder, Colorado, Conflict Research Consortium, University of Colorado.
- LEE, B. & LIPUMA, E. (2002) Cultures of Circulation: The Imaginations of Modernity. *Public Culture*, 14, 191-213.
- LEE, K. N. (1993) *Compass and gyroscope : integrating science and politics for the environment*, Washington, D.C., Island Press.
- LEHOUX, D. (2006) Laws of nature and natural laws. *Studies in History and Philosophy of Science*, 37, 527-549.
- LEMAN-STEFANOVIC, I. (2000) *Safeguarding our common future : rethinking sustainable development*, Albany, N.Y., State University of New York Press.
- LIPSEY, R. G. & LANCASTER, K. (1956-57) The General Theory of Second Best. *The Review of Economic Studies*, 24, 11-32.
- LOIBL, M. C. (2006) Integrating perspectives in the practice of transdisciplinary research. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- LOORBACH, D. (Undated) Governance and Transitions: A multi-level policy framework based on complex systems thinking. *Conference on Human Dimensions of Global Environmental Change*. Berlin.
- LOORBACH, D. & ROTMANS, J. (2006) Managing transitions for sustainable development. IN OLSHOORN, X. & WIECZOREK, A. J. (Eds.) *Understanding industrial transformation: views from different disciplines*. Dordrecht, Springer.
- LOORBACH, D. & VAN RAAK, R. (2005) Governance in Complexity: A multi-level policy framework based on complex systems thinking. *Lof der Verwarring*. Engels, Rotterdam, Dutch Research Institute for Transitions.
- LOWE, I. (2009) *A Big Fix: Radical Solutions for Australia's Environmental Crisis*, Melbourne, Victoria, Black Inc.
- MANSON, S. M. (2001) Simplifying Complexity: a review of complexity theory. *Geoforum*, 32, 405-414.
- MARTIN, R. (1998) ISO 14001 Guidance Manual. Oak Ridge, University of Tennessee.
- MARTINEZ-ALIER, J. & SCHLUPMANN, K. (1987) *Ecological economics : energy, environment, and society*, Oxford [Oxfordshire], Basil Blackwell.
- MASHAAL, M. (2006) *Bourbaki : a secret society of mathematicians*, Providence, R.I., American Mathematical Society.

- MAURER, B. (2005) *Mutual life, limited : Islamic banking, alternative currencies, lateral reason*, Princeton, N.J., Princeton University Press.
- MCDONALD, J. R. (2009) Complexity science: an alternative world view for understanding sustainable tourism development. *Journal of Sustainable Tourism*, 1-17.
- MCLURE, M. (2001) *Pareto, economics and society : the mechanical analogy*, London, Routledge.
- MEADOWCROFT, J. (2004) Deliberative Democracy. IN DURANT, R. F., FIORINO, D. J. & O'LEARY, R. (Eds.) *Environmental governance reconsidered : challenges, choices, and opportunities*. Cambridge, Mass. ; London, MIT Press.
- MEADOWS, D. H., MEADOWS, D. L. & RANDERS, J. (1992) *Beyond the limits : confronting global collapse, envisioning a sustainable future*, Post Mills, Vt, Chelsea Green Pub. Co.
- MEPPEM, T. (2000) The discursive community: evolving institutional structures for planning sustainability. *Ecological Economics*, 34, 47-61.
- MEPPEM, T. & BOURKE, S. (1999) Different ways of knowing: a communicative turn toward sustainability. *Ecological Economics*, 30, 389-404.
- METIN, A. & WARD, R. (1977) *Socialism without doctrine*, Chippendale, N.S.W, Alternative Publishing Co-operative.
- MILBRATH, L. W. (1989) *Envisioning a sustainable society : learning our way out*, Albany, State University of New York Press.
- MILLER, P. (1994) Accounting and Objectivity: The Invention of Calculating Selves and Calculable Spaces. IN MEGILL, A. (Ed.) *Rethinking objectivity*. Durham, Duke University Press.
- MIROWSKI, P. (1991) The When, the How and the Why of Mathematical Expression in the History of Economics Analysis *The Journal of Economic Perspectives*, 5, 145-157.
- MODVAR, C. & GALLOPIN, G. C. (2005) Sustainable development: epistemological challenges to science and technology. Santiago, Chile, United Nations.
- MOFID, K. & SZEGHI, S. (2010) Economics and Economists Engulfed By Crisis: What Do We Tell the Students. *Journal of Globalization for the Common Good*. Bibliotheca Alexandria, Egypt.
- MOON, F. C. (1992) *Chaotic and fractal dynamics : an introduction for applied scientists and engineers*, New York, Wiley.
- MOORE, B. (Ed.) (1999) *The Australian Oxford Dictionary*, South Melbourne, Oxford University Press.
- NEAL, L. (1990) *The rise of financial capitalism : international capital markets in the Age of Reason*, Cambridge New York,, Cambridge University Press ;.

- NICCOLUCCI, V., PULSELLI, F. M. & TIEZZI, E. (2007) Strengthening the threshold hypothesis: Economic and biophysical limits to growth. *Ecological Economics*, 60, 667-672.
- NICHOLSON (2010) Nicholson's Week. *The Weekend Australian*. Sydney, News Ltd.
- NORDHAUS, W. D. & TOBIN, J. (1973) Is Growth Obsolete? IN MOSS, M. (Ed.) *The Measurement of Economic and Social Performance, Studies in Income and Wealth*.
- NORGAARD, R. B. (1988) Sustainable development: a co-evolutionary view. *Futures*, 20, 606-620.
- NORTON, B. G. (1991) Ecological Health and Sustainable Resource Management. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.
- NORTON, B. G. (2005) *Sustainability : a philosophy of adaptive ecosystem management*, Chicago, University of Chicago Press.
- NOVAK, M. E. (1976) *Economics and the fiction of Daniel Defoe*, New York, Russell & Russell.
- O'BRIEN, M. (2000) *Making better environmental decisions : an alternative to risk assessment*, Cambridge ;, London : MIT Press.
- O'CONNOR, M. (2002) Reframing environmental evaluation: reasoning about resource use and the redistribution of sustainability. IN ABAZA, H. & BARANZINI, A. (Eds.) *Implementing sustainable development : integrated assessment and participatory decision-making processes*. Cheltenham, UK ; Northampton, MA, E. Elgar, for and on behalf of UNEP.
- O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (1998) *Sustainable development : concepts, rationalities, and strategies*, Dordrecht ; Boston, Kluwer.
- O'TOOLE, L. J., JNR (2004) Implementation theory and the challenge of sustainable development: the transformative role of learning. IN LAFFERTY, W. M. (Ed.) *Governance for sustainable development : the challenge of adapting form to function*. Cheltenham, UK ; Northampton, Mass., Edward Elgar.
- OPSCHOOR, H. (1994) Market Forces as Causes of Environmental Degradation. IN ZWEERS, W. & BOERSEMA, J. J. (Eds.) *Ecology, technology and culture*. Cambridge, White Horse.
- OPSCHOOR, H. & VAN DER STRAATEN, J. (1993) Sustainable Development: An Institutional Approach. *Ecological Economics* 7 203-222.
- ORMEROD, P. (1994) *The death of economics*, London, Faber.
- ORMEROD, P. (1999) *Butterfly economics : a new general theory of social and economic behavior*, New York, Pantheon Books.
- PAHL-WOSTL, C., CRAPS, M., DEWULF, A., MOSTERT, E., TABARA, D. & TAILLIEU, T. (2007) Social learning and water resources management. *Ecology and Society*.

- PAHL-WOSTL, C., MOSTERT, E. & TÀBARA, D. (2008) The growing importance of social learning in water resources management and sustainability science. *Ecology and Society*.
- PEARCE, D. W. & TURNER, R. K. (1990) *Economics of Natural Resources and the Environment*, Hemel Hempsted, Harvester.
- PERRINGS, C., MALER, K.-G., FOLKE, C., HOLLING, C. S. & JANSSON, B.-O. (1995) *Biodiversity loss : economic and ecological issues*, Cambridge New York : Cambridge University Press.
- PIATTELLI-PALMARINI, M. (1994) *Inevitable illusions : how mistakes of reason rule our minds*, New York, Wiley.
- POLANYI, M. (1967) *The tacit dimension*, London, Routledge & Kegan Paul.
- POLLOCK, J. L. (1993) The Phylogeny of Rationality. *Cognitive Science*, 17, 5563-588.
- POLLOCK, J. L. (2004) Irrationality and Cognition. *Inland Northwest Philosophy Conference on Knowledge and Skepticism*. Moscow, ID and Pullman, WA.
- POLLOCK, J. L. (2008) Epistemology, Rationality, and Cognition. IN STEUP, M. (Ed.) *A Companion to Epistemology*. 2nd Edition ed., Blackwells.
- PONTING, C. (1992) *A green history of the world*, London, Penguin.
- POOVEY, M. (1998) *A history of the modern fact : problems of knowledge in the sciences of wealth and society*, Chicago, University of Chicago Press.
- POOVEY, M. (2001) For everything else, there's ... *Social Research*, 68.
- POOVEY, M. (2003a) Can Numbers Ensure Honesty? Unrealistic Expectations and the U.S. Accounting Scandal. *Notices of the AMS*, 27-35.
- POOVEY, M. (Ed.) (2003b) *The financial system in nineteenth-century Britain*, New York, Oxford University Press.
- POOVEY, M. (2004) For what it's worth. *Critical Inquiry*, 30.2.
- POOVEY, M. (2008) *Genres of the Credit Economy: Mediating Value in Eighteenth- and Nineteenth-Century Britain*, Chicago, University of Chicago Press.
- PORTER, T. M. (1995) *Trust in numbers : the pursuit of objectivity in science and public life*, Princeton, N.J., Princeton University Press.
- PRESSMAN, J. L. & WILDAVSKY, A. B. (1973) *Implementation : how great expectations in Washington are dashed in Oakland*, Berkeley, University of California Press.
- PRIESTLEY, J. (1796) Considerations on the Doctrine of Phlogiston, and the Decomposition of Water.
- PUSEY, M. (1991) *Economic rationalism in Canberra : a nation-building state changes its mind*, New York, Cambridge University Press.
- RAMMEL, C., HINTERBERGER, F. & BECHTOLD, U. (2004) Governing Sustainable Development: A co-evolutionary perspective on transitions and change. *GoSD Working Paper*, 1, 34.

- RAMMEL, C. & VAN DEN BERGH, J. C. J. M. (2003) Evolutionary policies for sustainable development: adaptive flexibility and risk minimising. *Ecological Economics*, 47, 121 - 133.
- REES, W. E. (1992) Ecological footprints and appropriated carrying capacity: what urban economics leaves out. *Environment and Urbanization*, 4.
- RICHARDSON, B. J. (2002) *Environmental regulation through financial organisations : comparative perspectives on the industrialised nations*, Hague ; London, Kluwer Law.
- RICHARDSON, B. J. (2006) Sustainable Finance: Environmental Law and Financial Institutions. IN RICHARDSON, B. J. & WOOD, S. (Eds.) *Environmental law for sustainability : a reader*. Oxford, Hart Pub.
- RICHARDSON, B. J. (2008) *Socially responsible investment law : regulating the unseen polluters*, New York, Oxford University Press.
- RICHARDSON, B. J. & CRAIG, D. (2006) Indigenous Peoples, Law and the Environment. IN RICHARDSON, B. J. & WOOD, S. (Eds.) *Osgoode readers ; v. 1*. Oxford, Hart Pub.
- RICHARDSON, B. J. & RAZZAQUE, J. (2006) Public Participation and Environmental Decision-making. IN RICHARDSON, B. J. & WOOD, S. (Eds.) *Environmental law for sustainability : a reader*. v. 1. ed. Oxford, Hart Pub.
- RICHARDSON, B. J. & WOOD, S. (2006a) Environmental law for sustainability. IN RICHARDSON, B. J. & WOOD, S. (Eds.) *Environmental law for sustainability : a reader*. Oxford, Hart Pub.
- RICHARDSON, B. J. & WOOD, S. (2006b) *Environmental law for sustainability : a reader*, Oxford, Hart Pub.
- RIP, A. (2006) A co-evolutionary approach to reflexive governance – and its ironies. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- RISKIN, J. (2002) *Science in the age of sensibility : the sentimental empiricists of the French enlightenment*, Chicago, University of Chicago Press.
- RITCHEY, T. (2011) *Wicked Problems – Social Messes: Design Support Modelling with Morphological Analysis*, Berlin, Springer.
- RITTEL, H. J. & WEBBER, M. M. (1984) Planning problems are wicked problems. IN CROSS, N. (Ed.) *Developments in Design Methodology*. Chichester ; New York, Wiley.
- ROE, E. (1998) *Taking complexity seriously : policy analysis, triangulation and sustainable development*, Boston, Kluwer Academic.
- ROPKE, I. (1998) Sustainability and Structural Change. IN O'CONNOR, M., STRAATEN, J. V. D. & FAUCHEUX, S. (Eds.) *Sustainable development : concepts, rationalities, and strategies*. Dordrecht ; Boston, Kluwer.
- ROSEVEARE, H. (1973) *The Treasury, 1660-1870 : the foundations of control*, London New York, Allen and Unwin ;



Barnes and Noble.

- ROTHSCHILD, E. (2001) *Economic sentiments : Adam Smith, Condorcet, and the Enlightenment*, Cambridge, Mass. ; London, Harvard University Press.
- ROTMANS, J. (2006) Tools for Integrated Sustainability Assessment: a two-track approach. *Methods and Tools for Integrated Sustainability Assessment (Matisse Working Papers)*. Rotterdam, The Netherlands, DRIFT.
- ROTMANS, J., KEMP, R. & VAN ASSELT, M. B. A. (2001) More evolution than revolution: transition management in public policy. *Foresight*, 3.
- RUCCIO, D. F. & AMARIGLIO, J. (2003) *Postmodern moments in modern economics*, Princeton, N.J., Princeton University Press.
- RUTH, M. (1993) *Integrating economics, ecology, and thermodynamics*, Dordrecht ; Boston, Kluwer Academic.
- SACHS, I. (1999) Social Sustainability and Whole Development: Exploring the Dimensions of Sustainable Development. IN BECKER, E. & JAHN, T. (Eds.) *Sustainability and the social sciences : a cross-disciplinary approach to integrating environmental considerations into theoretical reorientation*. New York, Zed Books.
- SAMUELSON, P. A. (1939) Interactions between the Multiplier Analysis and the Principle of Acceleration. *Review of Economic Statistics*, 21, 75-78.
- SARKISSIAN, W., HOFER, N., SHORE, Y., VAJDA, S. & WILKINSON, C. (2009) *Kitchen Table Sustainability : Practical Recipes for Community Engagement with Sustainability* London, Earthscan.
- SCHABAS, M. (1990) A world ruled by number : William Stanley Jevons and the rise of mathematical economics. Princeton, N.J, Princeton University Press, University of Toronto, 1983.
- SCHABAS, M. (2003) Adam Smith's Debts to Nature. *History of Political Economy*, 262-281.
- SCHABAS, M. (2005) *The natural origins of economics*, Chicago, Ill. ; London, University of Chicago Press.
- SCHABAS, M. (2008) Hume's monetary thought experiments. *Studies in History and Philosophy of Science*, 39, 161-169.
- SCHACHT, R. (1990) Philosophical Anthropology: What, Why and How. *Philosophy and Phenomenological Research*, 50, 155-176. .
- SCHOFFMAN, A., TORDINI, A. & AMERICAN CHEMICAL SOCIETY. (2000) *ISO 14001 : a practical approach*, New York ; Oxford, Oxford University Press.
- SCHÖN, D. A. & REIN, M. (1994) *Frame reflection : toward the resolution of intractable policy controversies*, New York, BasicBooks.
- SCHUMACHER, E. F. (1976) *Small is Beautiful*, London, Abacus.
- SEDDON, G. (1972) *Sense of place : a response to an environment, the Swan coastal plain Western Australia*, Nedlands, W.A., University of Western Australia Press.

- SENDZIMIR, J., NMAGNUSZEWSKI, P., BALOGH, P. & VARI, A. (2006) Adaptive management to restore ecological and economic resilience to the Tisza river basin. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- SERAFY, S. E. (1991) The Environment as Capital. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.
- SIKOR, T. & NORGAARD, R. B. (1999) Principles for Sustainability: Protection, Investment, Co-operation and Innovation. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar.
- SIMONS, D. J. (2007) Inattentional blindness. *Scholarpedia*.
- SLIFE, B. D. (2004) Taking Practice Seriously: Toward a Relational Ontology. *Journal of Theoretical and Philosophical Psychology*, 24, 157-178.
- SMITH, C. (2006) *Adam Smith's political philosophy : the invisible hand and spontaneous order*, London ; New York, Routledge.
- SMITH, V. (2007) *Clean: a history of personal hygiene and purity*, Oxford, Oxford University Press.
- SMITHSON, M. (1988) *Ignorance and uncertainty : emerging paradigms*, New York, Springer-Verlag.
- SONDEIJKER, S., GEURTS, J., ROTMANS, J. & TUKKER, A. (2006) Imagining sustainability: the added value of transition scenarios in transition management. *Foresight*, 8.
- SPANGENBERG, J. H. (2001) Sustainable development : from catchwords to benchmarks and operational concepts. IN CHARTER, M. & TISCHNER, U. (Eds.) *Solutions: Developing Products and Services for the Future*. Sheffield, Greenleaf.
- SPASH, C. L. (1999) Reflections upon the role of moral sentiments in economics. IN KOHN, J. (Ed.) *Sustainability in question : the search for a conceptual framework*. Cheltenham, Elgar.
- SPASH, C. L., GETZNER, M. & STAGL, S. (2005) *Alternatives for environmental valuation*, London ; New York, Routledge.
- STEINBECK, J. (1992) *Cannery Row*, New York, Penguin Books.
- STEINER, F. R. (2002) *Human ecology : following nature's lead*, Washington, DC, Island Press.
- STERN, N. (2006) *The economics of climate change: The Stern Review*, Cambridge, UK, Cambridge University Press.
- STERN, N. H. (2009) *A blueprint for a safer planet : how to manage climate change and create a new era of progress and prosperity*, London, Bodley Head.
- STEWART, I. (1998) *Life's Other Secret: New Mathematics of the Living World*, The Penguin Press.

- STEYAERT, P. & OLLIVIER, G. (2007) The European Water Framework Directive: how ecological assumptions frame technical and social change. *Ecology and Society*.
- STIGLITZ, J. E., SEN, A. & FITOUSSI, J.-P. (2009) Report by the Commission on the Measurement of Economic Performance and Social Progress.
- STIRLING, A. (2006) Precaution, foresight and sustainability: reflection and reflexivity in the governance of science and technology. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- STOCKER, L. (2008) Pathways to Sustainability: Unit Information and Learning Guide. Perth, Western Australia, Curtin University Sustainability Policy Institute, Curtin University.
- STOCKER, L. & BURKE, G. (2009) A Participatory Approach to Mapping Sustainability Values Using Google Earth. IN MARINOVA, D. & MCGRATH, N. (Eds.) *Methodologies for Sustainability Research*. Cheltenham, UK (Forthcoming), Edward Elgar.
- STOCKER, L., BURKE, G., KENNEDY, D. & WOOD, D. (2012) Sustainability and Climate Adaptation: Using Google Earth to Engage Stakeholders. *Ecological Economics*, In Press.
- STOCKER, L. J. & BURKE, G. R. (2006) Overlay Mapping Technique for Sustainability. *Australian Association for Environmental Education*. Bunbury, Western Australia.
- STRANGE, S. (1986) *Casino capitalism*, Oxford, Eng., Basil Blackwell.
- STRAUCH, R. E. (1974) A Critical Assessment of Quantitative Methodology as a Policy Analysis Tool. *Rand Corporation Papers*. Santa Monica, California.
- STRAUSS, E. & LISOWSKI, M. (2000) *Biology: The Web of Life, ??*, Scott Foresman - Addison Wesley.
- STREET, P. (2004) Slaves Had Jobs Too. *ZNet: A community of people committed to social change*.
- SUSTAINABILITYINSTITUTE Why Use Systems Thinking?
- SVEDIN, U. (1991) The Contextual Features of the Economy-Ecology Dialogue. IN FOLKE, C. & KABERGER, T. (Eds.) *Linking the natural environment and the economy : essays from the Eco-Eco Group*. Dordrecht, Boston : Kluwer Academic Publishers.
- TÀBARA, J. D. & PAHL-WOSTL, C. (2007) Sustainability learning in natural resource use and management. *Ecology and Society*.
- TAKVER (2011) Record increase in greenhouse gas emissions for 2010. Independent Media Australia.
- TARRANT, D. (2008) The Root of the Matter. *In the Black*, 38-41.
- TEIVAINEN, T. (2002) *Enter economism, exit politics : experts, economic policy and the damage to democracy*, London, Zed.

- THIELE, L. P. (2000) Limiting risks: Environmental ethics as a policy primer. *Policy Studies Journal*, 28, 540-557.
- THOMPSON, J. (1996) *Models of Value: Eighteenth-Century Political Economy and the Novel*, Durham NC, Duke UP.
- TILES, M. (1984) *Bachelard : science and objectivity*, Cambridge [Eng.] ; Melbourne, Cambridge U.P.
- TURNBULL, C. M. (1968) *The forest people*, New York, Simon and Schuster.
- TURNBULL, C. M. (1972) *The mountain people*, New York, Simon and Schuster.
- TURNER, G. M. (2012) On the Cusp of Global Collapse? Updated Comparison of "The Limits to Growth" with Historical Data. *GAIA*, 21, 116-124.
- TURNER, K. The Blueprint Legacy – a review of Professor David Pearce's contribution to environmental economics policy. *CSERGE Working Paper*, PA.
- ULANOWICZ, R. E. (1991) Contributory Values of Ecosystem Resources. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.
- VAN DE KERKHOFF, M. & WIECZOREK, A. J. (2005) Learning and stakeholder participation in transition processes towards sustainability: Methodological considerations. *Technological Forecasting & Social Change*, 72, 733 - 747.
- VAN DER BRUGGE, R. & VAN RAAK, R. (2007) Facing the Adaptive Management Challenge: Insights from Transition Management *Ecology and Society*.
- VAN DER STRAATEN, J. (1994) An Economic Theory of Natural Resources. IN ZWEERS, W. & BOERSEMA, J. J. (Eds.) *Ecology, technology and culture*. Cambridge, White Horse.
- VANWYNSBERGHE, R., CARMICHAEL, J. & KHAN, S. (2007) Conceptualizing Sustainability: Simulating Concrete Possibilities in an Imperfect World. *Local Environment*, 12, 279-293.
- VERCELLI, A. (1993) *Hard Uncertainty and Environment*, Milan, Fondazione E. Mattei.
- VOSS, J.-P. & BAUKNECHT, D. (2006) Reflexive governance: a view on an emerging path. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (2006) *Reflexive governance for sustainable development*, Cheltenham, Edward Elgar.
- VOSS, J.-P. & KEMP, R. (2006) Sustainability and reflexive governance: introduction. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.
- WADDINGTON, C. H. (1977) *Tools for thought*, London, Jonathan Cape.
- WALKER, K. J. (2001) Uncertainty, epistemic communities and public policy. IN HANDMER, J. W., NORTON, T. & DOVERS, S. R. (Eds.) *Ecology, uncertainty*

*and policy : managing ecosystems for sustainability.* New York, Pearson Education.

WALLER, J. (2004) *The Discovery of the Germ*, Crows Nest, NSW, Allen and Unwin.

WALSH, V. & GRAM, H. (1980) *Classical and neoclassical theories of general equilibrium : historical origins and mathematical structure*, New York, Oxford University Press.

WARING, M. J. (1988) *Counting for nothing : what men value & what women are worth*, Wellington, N.Z., Bridget Williams.

WATTS, A. W. (1951) *The Wisdom of Insecurity: A Message for an Age of Anxiety*, New York, Pantheon Books.

WEAVER, P. M. & ROTMANS, J. (2006) *Integrated Sustainability Assessment: What? Why? How? Methods and Tools for Integrated Sustainability Assessment (Matisse Working Papers)*. Rotterdam, The Netherlands, DRIFT.

WEBB, K. (2005) *Sustainable Governance in the Twenty-First Century*. IN ELIADIS, F. P., HILL, M. M. & HOWLETT, M. (Eds.) *Designing government : from instruments to governance*. Montréal, McGill-Queen's University Press.

WEBER, K. M. (2006) Foresight and adaptive planning as complementary elements in anticipatory policy-making: a conceptual and methodological approach. IN VOSS, J.-P., BAUKNECHT, D. & KEMP, R. (Eds.) *Reflexive governance for sustainable development*. Cheltenham, Edward Elgar.

WEBER, M. (1959) *The Protestant Ethic and the Spirit of Capitalism*, Chas Scribner's sons.

WEINTRAUB, E. R. (2002) *How economics became a mathematical science*, Durham [N.C.] ; London, Duke University Press.

WELTY, C. & GUARINO, N. (2001) Supporting ontological analysis of taxonomic relationships. *Data & Knowledge Engineering*, 39, 51-74.

WHITE, R. S. (1996) *Natural Law in English Renaissance literature*, New York, Cambridge University Press.

WHITELAW, K. (2004) *ISO 14001 environmental systems handbook*, Boston, Elsevier/Butterworth-Heinemann.

WIKIPEDIA Ontology of concepts.

WILBER, K. (1995) *Sex, ecology, spirituality : the spirit of evolution*, Boston, Shambhala.

WINTHER, R. G. (2008) "Vicious Abstractionism" and "the Philosophic Fallacy": James and Dewey on the Promises and Limits of Abstraction. Department of Philosophy, University of California, Santa Cruz.

WOLFF, J. & HAUBRICH, D. (2006) Economism and its Limits. IN MORAN, M., REIN, M. & GOODIN, R. E. (Eds.) *The Oxford handbook of public policy*. New York, Oxford University Press.

- WOOD, W. E. (1924) Increase of Salt in Soil and Streams following the Destruction of the Native Vegetation. *Journal of the Royal Society of Western Australia*, Vol.X, 35-47.
- WOODMANSEE, M. & OSTEEN, M. (1999) *The new economic criticism : studies at the intersection of literature and economics*, London ; New York, Routledge.
- WRAY, K. B. (2007a) The cognition dimension of theory change in Kuhn's philosophy of science. *Studies in History and Philosophy of Science*, 38, 610-613.
- WRAY, K. B. (2007b) Kuhnian revolutions revisited. *Synthese*, 158, 61-73.
- WYNN, B. (1992) Uncertainty and environmental learning: reconceiving science and policy in the preventive paradigm. *Global Environmental Change*, 111-127.
- WYNN, B. (2002) Risk and environment as legitimacy discourses of technology: reflexivity inside out? *Current Sociology*, 50, 459-477.
- YOUNG, M. D. (1993) *For Our Children's Children: Some Practical Implications of Inter-Generational Equity and the Precautionary Principle*, Canberra, Australia, Resources Assessment Commission, Australian Government Publishing Service.
- ZWEER, W. (1994) In Search of an Ecological Culture: Environmental Philosophy in the 1990s. IN ZWEERS, W. & BOERSEMA, J. J. (Eds.) *Ecology, technology and culture*. Cambridge, White Horse.
- ZYLICZ, T. (1991) The Role for Economic Incentives in International Allocation of Abatement Effort. IN COSTANZA, R. & WAINGER, L. (Eds.) *Ecological economics : the science and management of sustainability*. New York, Columbia University Press.

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