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EDITORIAL

The first feature article by Don Clifton in the third edition of the *Journal of the Asia Pacific Centre for Environmental Accountability* for 2010 is a literature review and analysis of how Ecological Footprint Analysis can be applied to assess the consequences of local behaviour in terms of its contribution to, or detraction from, the goal of humanity living sustainably at the global level. The second feature article, by Dayana Jalaludin, Maliah Sulaiman and Nik Nazli Nik Ahmad offers a review of the literature regarding EMA adoption followed by a survey which explores the associations between EMA, environmental performance and economic performance

Finally, our regular **Environment Extra!** is followed with information about **Forthcoming Conferences**.

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EDITORIAL BOARD

A SUSTAINABLE WORLD – THE LOCAL IN TERMS OF THE GLOBAL: AN ECOLOGICAL FOOTPRINT ANALYSIS PERSPECTIVE

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Abstract
This paper considers, by way of literature review and analysis, how Ecological Footprint Analysis (**Footprint-Analysis**) can be applied to assess the consequences of local behaviour in terms of its contribution to, or detraction from, the goal of humanity living sustainably at the global level (that is, for there to be a **sustainable-world**). The South Australian setting is used as a case study against which the theoretical findings are applied, and shows that South Australia's citizens are, in Footprint-Analysis terms, detracting from a global sustainable-world goal. The South Australian Government's Ecological-Footprint reduction target, although having 40-years for its achievement, will not remedy this problem.

1. Introduction

This paper reports on a component of a current research project (the **Project**) that is concerned with what it means for humanity to live sustainably, that is, for there to be a **sustainable-world**, and how this might be achieved (for a summation of the entire Project, see Clifton (2010b)). The component addressed in this paper is how Ecological Footprint Analysis (**Footprint-Analysis**) can be used to assess human behaviour at a sub-global unit of analysis level (say, a nation, a sub-nation state, or a local community) in terms of its contribution to, or detraction from, a global sustainable-world goal. Exploration of this **local-to-global** theme is conducted by way of a literature review and analysis, with a case study of the South Australian setting used as an example against which the theoretical findings are applied. In presenting this analysis, the paper proceeds as follows.

Section 2 overviews what it means for there to be a sustainable-world through a brief introduction to two main sustainable-world approaches, the Reformist approach and the Transformational approach. A sustainable-world typology, that summarises key characteristics of these two approaches, is introduced. The typology then forms the framework on which the Footprint-Analysis assessment of the local-to-global is structured.

Section 3 overviews the Footprint-Analysis concept. The various Footprint-Analysis components, and its representation of a necessary, but not sufficient, condition for there to be a sustainable-world – for humanity to live within the limits of resource flows generated by the Earth's renewable natural resource (**K_{NR}**) base – are discussed. Some key issues for consideration in using and interpreting Footprint-Analysis data are also reviewed, as is its suitability for use in conducting a local-to-global assessment.

Although Footprint-Analysis is specific in its purpose in presenting a measure of whether humanity is using K_{NR} within the limits of its flows, as opposed to depleting the K_{NR} capital base, the implications of humanity's K_{NR} use extend to other aspects of what it means for there to be a sustainable-world. Section 4 explores this issue and presents a Footprint-Analysis assessment of current human behaviour in terms of its consistency or otherwise with the broad set of dimensions shown in the sustainable-world typology that

collectively give meaning to the sustainable-world concept.
Section 5 considers how a Footprint-Analysis local-to-global assessment can be undertaken, and sets out four tests that can be applied to a sub-global unit of analysis to consider if this unit's use of K_{NR} is: (a) consistent with the Footprint-Analysis requirement of humanity living within the limits of available K_{NR} flows, and (b) consistent with principles of social justice that are fundamental to the sustainable-world concept.

Section 6 applies the issues covered in the first 5 sections of the paper to consider the South Australian setting in terms of its contribution to, or detraction from, a global sustainable-world goal. Section 7 concludes with summary comments, including a discussion on the key contributions to knowledge, limitations, and areas for future research.

2. A sustainable-world

The sustainable-world concept is pluralistic, contested, and grounded in different world-views and cultural contexts (Osorio, Lobato & Castillo 2005; Manderson 2006). This plurality makes it virtually impossible to reduce the concept's meaning to a single and purposeful definition (Dobson 1996). Instead, the analysis in this paper proceeds on the basis of this plurality and presents the meaning of a sustainable-world in the form of a sustainable-world typology, shown as Appendix A. (Appendix A shows an abbreviated version of the typology that was developed as part of the broader Project on which this paper is based – for a complete version of the typology, a review of how it was developed, and a discussion of its key themes, see Clifton (2010a)).

The sustainable-world typology presents two main streams of sustainable-world thought that are evident in the literature: (a) the Reformist approach, which focuses the achievement of a sustainable-world on reforming the current dominant socio-economic system through changes at the margin to make this system more environmentally responsible and socially just (i.e., more **green-and-just**), and (b) the Transformational approach, which claims that progressing to, and the maintaining of, a sustainable-world requires fundamental and transformational socio-economic system change. Reformism is the current dominant sustainable-world approach (Handmer & Dovers 1996; Gould & Lewis 2009), and is consistent with mainstream sustainable-development narratives at national and international political levels, and within business circles (Castro 2004; Robinson 2004).

Despite the Reformist and Transformational approaches being substantially different and grounded in alternate and incommensurate paradigms, they both see the primary goal of a sustainable-world in terms of the flourishing of life on Earth, incorporating human and ecological wellbeing, maintained over an indefinite time frame, and with this wellbeing grounded in principles of intra-generational and inter-generational justice (collectively referred to in this paper as the **wellbeing + justice** sustainable-world principles).

But how can it be known if the citizens of a particular unit of analysis – say, a nation, a sub-nation state, or a local community – are living in ways that are supportive of this primary sustainable-world goal and, more generally, supportive of the full range of dimensions shown in the sustainable-world typology for either or both of the Reformist and Transformational approaches? Ecological Footprint Analysis (**Footprint-Analysis**) is one approach that can be used to conduct such an assessment, and the discussion will now turn to exploring how Footprint-Analysis can be applied for this purpose.

3. Ecological Footprint Analysis

3.1. Overview

Footprint-Analysis follows a three-step process (Footprint Network 2010). Firstly, an **Ecological-Footprint** measure, usually expressed in standardised units of global hectares per capita (**ghpc**), is calculated to show the rate at which a unit of analysis (say, a city, nation, or all of humanity) is using the Earth's renewable natural resources (**K_{NR}**) from a physical consumption and waste sink perspective. Next, a **Biocapacity** measure is determined, which represents the regenerative and waste-sink capacity of K_{NR} stocks (i.e. it represents available K_{NR} flows), also expressed as ghpc. Finally, the Ecological-Footprint and Biocapacity measures are compared to determine a measure of **ecological-credit** or **ecological-deficit**. A global-level ecological-deficit means that humanity's use of K_{NR} exceeds its flows, resulting in the depletion of K_{NR} stocks.

The use of a standardised measure – global hectares per capita – in the Footprint-Analysis process allows the comparison of data between different units of analysis, making Footprint-Analysis suited to the local-to-global critique that is the subject of this paper.

The Ecological-Footprint takes two forms (Footprint Network 2010): (a) a consumption-based measure which represents the K_{NR} a unit of focus consumes regardless of where the production of consumed goods occurs; this is the most common form of the Ecological-Footprint and is the measure referred to in this paper unless stated otherwise, and (b) a production-based measure which calculates an Ecological-Footprint based on all production and waste generation within the borders of the unit of analysis in question, including those incurred in the production of exports. Both of these approaches will be considered later in this paper.

3.2. Footprint-Analysis and a sustainable-world

Footprint-Analysis does not capture every aspect of what it means for humans to live sustainably. Instead, it measures what is claimed to be a necessary, although insufficient, condition for there to be a sustainable-world – that humanity lives within the Earth's Biocapacity limits (Kitzes 2007; Footprint Network 2010). But is this, in fact, a necessary sustainable-world condition as is claimed? This is an important question to consider as the arguments presented here rest to a material degree on the validity of this claim.

At a global level, and over an extended time frame, the claim must be true. The reason is that continued ecological-deficit results in continued depletion of the Earth's K_{NR} stocks, which erodes the very fabric on which life on Earth depends. At some point, continued K_{NR} stock depletion must reach a point where those stocks are not able to sustain flourishing-life as it is understood within the sustainable-world context. Temporary states of K_{NR} stock depletion may not necessarily be a problem, but longer term continuation of this depletion is.

One potential rebuttal to this view is grounded in the weak-sustainability vs. strong-sustainability argument (Daly 1990; Common & Stagl 2005). Some authors (e.g., Caviglia-Harris, Chambers & Kahn (2009)) claim that Footprint-Analysis presents a strong-sustainability view which, in its basic form, and although having various permutations and complexities, proposes that, (a) a sustainable-world requires K_{NR} and human-forms of capital (i.e., capital that is made by humans, or is otherwise part of the human social domain – $\mathbf{K_{HF}}$) be maintained independently and, (b) if substitution of K_{NR} by K_{HF} is possible, it is only so at the margin. If this claim that Footprint-Analysis represents a strong-sustainability approach is right, then a weak-sustainability view – which, again in simplistic terms, proposes that a sustainable-world requires the maintaining of the aggregate of K_{NR} and K_{HF}, but substitution of one for the other, especially K_{NR} for K_{HF}, is acceptable – may see the Footprint-Analysis sustainable-world requirement as unnecessarily onerous.

This strong-sustainability view of Footprint-Analysis is, however, not shared by all. Some authors claim that Footprint-Analysis is, to the contrary, more consistent with weak-sustainability (e.g., Nourry (2008)). A more likely interpretation is proposed by Senbel, McDaniels & Dowlatabadi (2003) who suggest Footprint-Analysis assumes neither weak-sustainability nor strong-sustainability – it is merely concerned with humanity living within Biocapacity limits, but is indifferent to how this result is achieved. Under this view, a strong-sustainability approach might require the living-within-Biocapacity-limits condition to be met over any and all time periods, and for no material degradation of the regenerative capacity of K_{NR} stocks to occur (this is consistent with the Transformational sustainable-world narrative – see Appendix A – item 5.3). A weak-sustainability approach might allow time periods where human use of K_{NR} beyond Biocapacity limits can occur, and allow substitution of K_{NR} by K_{HF} alternates, so long as critical K_{NR} levels are not breached and the long-term trend is one of living within Biocapacity limits (this is consistent with the Reformist narrative – (see Appendix A – item 5.3)). Either of these approaches can be consistent with the live-within-Biocapacity objective.

The key point is that in the sustainable-world context, even weak-sustainability requires the maintaining of critical levels of K_{NR} and rejects the idea of perfect substitution of K_{NR} by K_{HF} (Dobson 1996; O'Neill, Holland & Light 2008). In this respect, depletion of K_{NR} stocks through continued ecological-deficit breaches the requirements of both weak-sustainability (by threatening critical K_{NR} thresholds) and strong-sustainability (through general K_{NR} depletion).

3.3. Data and interpretation issues

Before considering the detail of how Footprint-Analysis can be used for the local-to-global assessment, it is important to clarify a number of issues concerning the raw Footprint-Analysis data in order for these data to be used in a meaningful way. This section, 3.3, addresses the key issues that are relevant to the objectives of this paper.

3.3.1. Published Footprint-Analysis data

Figure 1 displays the current global-level Footprint-Analysis summary data, and Figure 2 shows these data dissected into national-income groups. The key observations from are: (a) humanity's collective Ecological-Footprint exceeds total Biocapacity and hence humanity is not living sustainably in Footprint-Analysis terms, and (b) there is significant inequality in the per capita use of K_{NR}, with citizens of high-income nations having, on average, an Ecological-Footprint of approximately six-times that of low-income nations and, although holding only 16% of the global population, high-income nations account for 36% of total K_{NR} use (Figure 2).

Figure 1: Current Footprint-Analysis data

Item	Value
Global average Ecological-Footprint. #1	2.6-ghpc
Global average Biocapacity. #1	1.8-ghpc
Ecological-Footprint as a % of Biocapacity. #2	144%

Data sources:
#1: Footprint Network (2009)
#2: Author calculation.

What is not apparent from these data is how much of the total Biocapacity is actually available for human use. Understanding this issue is important as: (a) it determines the maximum global-level Ecological-Footprint that humanity can have yet still live sustainably, and (b) it provides a means of assessing humanity's ecological-deficit position relative to the amount of Biocapacity that can safely be utilised, as opposed to simply using as a base-line the Biocapacity that physically exists.

Figure 2: Ecological-Footprint by national income – actual global hectares and global hectares per capita (ghpc)

	Population: % of global total	Ecological-Footprint: actual hectares per region		Ecological-Footprint per capita
		Millions of gh	% of global total	
World	100%	17,091	100%	2.6 ghpc
High-income nations	16%	6,197	36%	6.1 ghpc
Middle-income nations	65%	7,609	45%	1.8 ghpc
Low-income nations	19%	1,314	8%	1.0 ghpc

Data source: Footprint Network (2009)

3.3.2. Biocapacity available for human use

Clifton (2010c) identifies three key issues in determining how much Biocapacity humanity can safely utilise within the sustainable-world context. First is to allow for the Biocapacity needs of non-human species, as the Biocapacity measure ignores this (Footprint Network 2010). Estimates of how much Biocapacity should be set aside range from 10%-12%, to 40%-60%+ (Soulé & Sanjayan 1998; Wackernagel & Yount 1998; Stokstad 2005). Lower values (10%-12%) are, however, seen as likely to drive continued biodiversity loss at rates inconsistent with sustainable-world objectives, with figures in the 40%-60%+ range considered more appropriate (Soulé & Sanjayan 1998; Stokstad 2005)). Next is the issue of ecological resilience (Gunderson & Holling 2002; Walker & Salt 2006) and the need to maintain resilience enhancing ecosystem characteristics such as spare capacity, diversity, and adaptive capacity, to improve the likelihood that a sustainable-world can be realised. Third is the conservative nature of Footprint-Analysis data, where the calculated Ecological-Footprint measure is likely to be understated, available Biocapacity overstated, and the current ecological-deficit value understated (Kitzes et al. 2007; Wackernagel 2009).

The amount of Biocapacity that can be safely utilised by humanity is not well addressed in the literature, however using 100% of available Biocapacity is not sustainable. To allow for the three points discussed above, Clifton (2010c) presents two scenarios in reassessing the base Footprint-Analysis data, namely: (a) 20% of Biocapacity unavailable for human use (although Clifton sees this as unlikely to be adequate), and (b) 50% unavailable for human use (which Clifton proposes, although sitting in the higher-end range of needed allowances for biodiversity protection, may still be inadequate when resilience and conservative data issues are accounted for).

Despite these acknowledged reservations, the 20% and 50% values are used in this paper with the modified calculations of the data in Figure 1 shown as Figure 3. These revised data show that: (a) the extent of humanity's ecological-deficit position, where ecological-deficit is based on Biocapacity that humanity can safely utilise as opposed to what might physically exist, is significantly greater than the standard Footprint-Analysis data reveals, and (b) in order to be living within available Biocapacity limits, and hence living sustainably in Footprint-Analysis terms, humanity needs to have a current global average Ecological-Footprint somewhere in the 0.9-ghpc to 1.4-ghpc range as compared to the current 2.6-ghpc value.

Figure 3: Current Footprint-Analysis data with modified Biocapacity values

Item	Value
Global average Ecological-Footprint. #1	2.6-ghpc
1. Biocapacity – 20% unavailable for human use.	
Global average Biocapacity available for human use. #2	1.4-ghpc
Ecological-Footprint as a % of available Biocapacity. #2	181%
2. Biocapacity – 50% unavailable for human use.	
Global average Biocapacity available for human use. #2	0.9-ghpc
Ecological-Footprint as a % of available Biocapacity. #2	289%

Data sources:
#1: Footprint Network (2009): 2009 release based on 2006 data.
#2: Author calculation.

4. A sustainable-world – global assessment

In section 3.3.1 it was noted that humanity is currently not living sustainably in Footprint-Analysis terms. But what are the flow-on implications to the broader set of sustainable-world dimensions set out in the sustainable-world typology? In this section, this question is considered by an overview of an analysis that was undertaken as part of the broader Project on which this paper is based. This analysis considered each of the sustainable-world dimensions in terms of: (a) the current Footprint-Analysis data, (b) existing literature that considers the implications of, and interpretation of, these data, and (c) other known information about the current state of the world that adds to the insights Footprint-Analysis data offers. Appendix B summarises the findings.

The Appendix B content is important in that it shows the broader implications that arise in the event of a unit of analysis being shown, in Footprint-Analysis terms, to be detracting from the achievement of a global sustainable-world goal. That is, if a unit of analysis is not living sustainably in Footprint-Analysis terms, this has flow-on implications across the broad set of dimensions that collectively represent what it means for there to be a sustainable-world.

This section, rather than providing a line-by-line review of the Appendix B content, focuses instead on some of the main themes evident in it to aid in a more detailed reading of both this Appendix, and the sustainable-world typology (shown as Appendix A) on which it is structured. The discussion is framed around the two key messages evident in the Footprint-Analysis data referred to in section 3.3.1 namely: (a) global ecological-deficit, and (b) inequity in K_{NR} use.

4.1. Ecological-deficit

The consequences of global ecological-deficit are born by three main parties: (a) the economically and politically weak, as the more powerful are better able to appropriate resources for their own use, (b) non-human species, through human appropriation of K_{NR} to the detriment of these species, and (c) future generations, through the running down of K_{NR} stocks to support current-generation consumption (Andersson & Lindroth 2001). Evidence of these impacts is well documented including: (a) the high levels of resource consumption – food for example – by some members of society while others do not even have vital survival needs met (Tansey & Rajotte 2008), (b) high, and accelerating, levels of species extinction, (UNEP 2007), (c) increasing atmospheric CO_2 loads that present significant risks from the flow-on impacts of global warming and ocean acidification (UNEP 2007), (d) and the general broad-scale degradation of the Earth's ecosystems (Brown 2008).

This position of ecological-deficit is not a mere one-off. As per Figure 4, the standard Footprint-Analysis data shows this ecological-deficit position existing from around 1980, however when Biocapacity not available for human use is considered, and using the 50%-not-available assumption, ecological-deficit is evident from at least 1961 (the date from which Footprint-Analysis data are available). To make matters worse, the degree of ecological-deficit is increasing over time, with no signs evident of a reversal of this trend.

Figure 4: Humanity's Ecological-Footprint and Biocapacity through time

	1961	**1970**	**1980**	**1990**	**2006**
EF ghpc for all of humanity #1	2.3	2.6	2.6	2.5	2.6
1. Biocapacity ghpc – 100% for human use #1	3.7	3.1	2.6	2.2	1.8
EF as % of Biocapacity #2	62%	83%	***100%***	112%	144%
2. Biocapacity ghpc - 80% for human use #2	3.0	2.5	2.1	1.8	1.4
EF as % of Biocapacity #2	77%	***104%***	125%	140%	180%
3. Biocapacity ghpc - 50% for human use #2	1.9	1.6	1.3	1.1	0.9
EF as % of Biocapacity #2	***123%***	166%	200%	224%	287%

Data sources:
#1: Footprint Network (2009)
#2: Author calculation.

This continued ecological-deficit is inconsistent with both the Reformist and Transformational sustainable-world approaches. Firstly, it is a breach of justice principles (Appendix A – items 3.1 and 5.2) between members of the current generation (i.e., the powerful benefiting at the expense of the weak) and between members of the current generation and those yet to come (i.e., the passing on to future generations of a degraded K_{NR} stock). This is particularly troublesome as both the Reformist and Transformational approaches view social justice as a defining sustainable-world principle (Diesendorf 1997; Barry 2003).

Next, continued ecological-deficit is a breach of weak-anthropocentric obligations embraced by both the Reformist and Transformational approaches. From a weak-anthropocentric perspective, a sustainable-world has to do with the satisfaction of human fulfilment-interests (that is, those interests that are conducive to the flourishing of life) based on considered-human-preferences (Appendix A – item 1.2). In the sustainable-world context, considered-human-preferences are preferences consistent with a rationally adopted sustainable-world view, including consideration of the interests of future generations and members of the current generation, the integrity of ecosystems, and of human values beyond mere immediate need satisfaction. These considered-preferences flow throughout the sustainable-world typology and form the basis of the full suite of dimensions shown in it. Continued ecological-deficit and its consequences are in breach of these weak-anthropocentric obligations. In addition, ecological-deficit and its resulting K_{NR} degradation are inconsistent with the ecocentric view embraced in the Transformational approach, with far-reaching implications throughout the entire Transformational narrative.

4.2. Inequity

As for ecological-deficit, the implications of inequity in Biocapacity use flow throughout the sustainable-world typology for both the Reformist and Transformational approaches. For Reformism, the key issue is equity within the human domain – both within the current generation, and between the current and future generations. The Transformational approach extends this to include equity between humans and non-human species.

The core issue however is this. For humanity to live sustainably in Footprint-Analysis terms, the average global Ecological-Footprint needs to reduce from the current level of 2.6-ghpc to somewhere in the 0.9-ghpc to 1.4-ghpc range (based on the Biocapacity-use assumptions used in this paper, and as shown in Figure 3). But based on the mid-range UN human population projection to 2050 of 9-billion, and holding all else constant, the 2050 available Biocapacity range will reduce to 0.7-ghpc to 1.1-ghpc (Clifton 2010c). However, of the 124 nations listed in the most recent set of Footprint-Analysis accounts (Footprint Network 2009), only 23 have a current Ecological-Footprint of 1.1-ghpc or less, and of these, only 3 have a value of 0.7-ghpc or less. All of these nations fit within a low or least-developed nation status. So in order for humanity to live sustainably by way of Biocapacity use, some form of equitable sharing of available Biocapacity needs to be achieved in a way that sees flourishing lives for all, but done so at Biocapacity-use levels that are currently being experienced by only a handful of the lest-developed nations on Earth. This is clearly an enormous challenge but one that needs to be confronted.

5. Assessing the local in terms of the global

To live sustainably in Footprint-Analysis terms, humanity needs to limit its use of the Earth's renewable natural resources (**K_{NR}**) to the level of Biocapacity (i.e., available K_{NR} flows) that is safely available for human use. In this respect, for a sub-global unit of analysis to be contributing positively to a sustainable-world, it needs to be using Biocapacity in a way that is consistent with this global live-within-available-Biocapacity goal, but to also do so in ways consistent with the general sustainable-world wellbeing+justice principles described in section 2 and detailed in the sustainable-world typology shown as Appendix A.

Four key non-mutually exclusive 'tests' to addressing this Biocapacity-use issue are evident in the literature that provides a means of assessing whether a sub-global unit of analysis is living sustainably in Footprint-Analysis terms. In this section, each of these tests is assessed after which, in Section 6, the tests are applied in the South Australian setting.

5.1. Consumption Ecological-Footprint and local Biocapacity

The first test is a requirement that a region's *consumption-based* Ecological-Footprint remains within that region's Biocapacity limits. This argument is mostly targeted towards nations or other substantial regional areas such as within-nation states, or multi-nation regions. The argument is that, if all regions met this criterion, then the global-level living-within-Biocapacity-limits requirement would also be met.

Three main arguments are made against the merits of this approach, namely: (a) regional boundaries are arbitrary human constructs that do not necessarily have any meaningful relationship to how population numbers are dispersed across landscapes, or how biologically productive those landscapes are (Lenzen & Murray 2001; Nijkamp, Rossi & Vindigni 2004), (b) following from this first point, and as a consequence of how regional boundaries have been defined and how population numbers have settled over time, not all regions can live within their own Biocapacity limits or, with the ability to trade and transport goods, do they necessarily need to (Nijkamp, Rossi & Vindigni 2004; Dietz & Neumayer 2007), and (c) the linking of a region's Ecological-Footprint to its own Biocapacity does not consider the fairness of the region's Ecological-Footprint relative to broader social justice issues; in this respect, living-within-regional-Biocapacity may create a false sense of comfort that the region's Ecological-Footprint is sustainable when, in the global context, it may be far from it (Andersson & Lindroth 2001; Footprint Network 2006).

The main argument in favour of this approach is that it allows a region, if it choses, to live off its own Biocapacity supplies and not be subject to the risks of resource competition in the broader global space. Having a consumption-based Ecological-Footprint within local Biocapacity limits then becomes a risk management and security-enhancing mechanism (Wackernagel & Yount 1998; Footprint Network 2008).

5.2. Production Ecological-Footprint and local Biocapacity

Next is a requirement that a region's *production-based* Ecological-Footprint remains within its Biocapacity limits. The idea here is that this approach provides one way of limiting the K_{NR} impact of production that occurs within a region's borders to the K_{NR} within those borders, effectively internalising those impacts. This, however, still leaves unanswered the question of what consumption-based Ecological-Footprint constraints a region's citizens should be living within. It also ignores both the magnitude and consequences of consumptive behaviours where, for example, local K_{NR} can be preserved by importing K_{NR} from other regions and possibly degrading the K_{NR} of those regions in the process.

Despite these weaknesses, this approach has its merits, including: (a) it offers a current-day measure of regional human K_{NR} appropriation, which can help address the problem of time-lags in ecosystem feedback; these time-lags can otherwise result in the negative consequences of human impacts on ecosystems materialising at some time into the future, well after the damage has been done (Gibson 2001; Meadows, Randers & Meadows 2004), (b) it internalises the consequences of production activities onto the current-day regional community in both time and space, which can help address possible social justice violations, such as pushing onto future generations the negative consequences of current human behaviour (see Appendix A – item 5.2), and (c) protecting local K_{NR} reduces the risks of local ecological degradation which, if it occurred, may also negatively impact on other regions (say, local desertification contributing to the degrading of ecosystems in neighbouring regions) (WCED 1987; Handmer & Dovers 1996).

As for the consumption-based approach, this approach is one where, if all regions followed its requirements, the global Footprint-Analysis sustainable-world condition would be met. Unlike the consumption-based approach however, the production-based approach is one that all regions could be expected to meet and which, if done, would see each region play its part in limiting the aggregate global use of Biocapacity to available levels.

5.3. Fair-Earth-share

The third test is one that sets aside regional specifics, and instead looks at the Earth's Biocapacity as a single global resource to be shared by all of humanity. The idea is that access to, and use of, global Biocapacity should not be determined merely by accidents of time and place (i.e., not based on being born in a particular location or social setting, on how national borders came about, or on how population numbers have settled). Rather, it claims that all of humanity has an equal right to the Earth's Biocapacity, that is, a right to a **fair-Earth-share**, where the fair-Earth-share value is equal to total global Biocapacity that can safely be used by humans, divided by the total global population (Collins et al. 2006; Giljum et al. 2007). Application of this fair-Earth-share concept means that: (a) if the per capita Ecological-Footprint of any unit of focus – such as a nation, sub-nation state, local community, or individual – is equal to or less than the fair-Earth-share, then that unit is living sustainably in Footprint-Analysis terms, or (b) if the unit of focus has a per capita Ecological-Footprint in excess of the fair-Earth-share, then that unit is detracting from a global sustainable-world objective and, in this sense, is not living sustainably (for examples of this application, see Simpson (2000) and Nijkamp, Rossi & Vindigni (2004)). This fair-Earth-share concept is a strong theme in the Transformational sustainable-world approach (see Appendix A – item 5.2), however its application for the Reformist approach is not so clear. Reformism is more concerned with ensuring all members of society have their needs met in order to live flourishing lives but, beyond this, narratives are not strong on equality in Biocapacity sharing; they focus instead on the equitable sharing of the benefits of continued green-and-just economic growth (see Appendix A – item 5.2). Despite this, it is challenging to see how even under the Reformist approach, sustainable-world justice principles could justify the sharing of globally available Biocapacity in any way that is materially different to the fair-Earth-share concept.

The main advantages of this approach are that: (a) it directly addresses issues of distributive justice where, in a world of limited Biocapacity supply, and one where available Biocapacity is fully utilised such that more for some means less for others, the fair-Earth-share concept can be quite appealing, and (b) it is an approach that is generalisable to all and sets clear criteria as to whether a unit of focus is living in ways consistent with, or in conflict with, a global sustainable-world goal. Despite these advantages, this approach is not without its challenges, two of which are particularly relevant to the issues addressed in this paper, namely: (a) population, and (b) national sovereignty.

Concerning population, the fair-Earth-share approach does not directly confront the question of population numbers. From a per-capita perspective, an increasing global population is Biocapacity eroding – more people means a smaller fair-Earth-share. As such, even if a region reduced its Ecological-Footprint to fair-Earth-share limits, and did so with no population growth, population growth in other regions could lower the fair-Earth-share Biocapacity value making, through no fault of its own, the otherwise 'sustainable' region 'unsustainable' (Daly 1996).

Next is the issue of national-sovereignty, and the rights of nations to make their own decisions as to how the K_{NR} within their borders is dealt with, which is a well established principle in international declarations and agreements (e.g., see UN (1992b; 1992a)). When dealing with the use of Biocapacity that is part of the global commons (e.g., the atmosphere in relation to CO_2 emissions), the fair-Earth-share concept is relatively easy to accommodate within this national-sovereignty regime. When dealing with physical K_{NR} within a nation's borders however, this becomes more challenging. It is possible, for example, to imagine a nation that deliberately embarks on a low-population policy and actively protects its K_{NR} for a purpose of ensuring its citizens are able to live flourishing lives but, as it turns out, utilising per capita Biocapacity in excess of a fair-Earth-share. Whether such a nation exists is another question, but the point is that the fair-Earth-share principle can, on its own, have the effect of undermining the national sovereignty principle, turning local K_{NR} into a form of global commons, and watering down any benefits communities might expect to enjoy from taking strong local action to progress sustainable-world objectives. Some fair-Earth-share proponents have proposed solutions to this by allocating resource rights based on population numbers at a point in time (McLaren 2003), however many challenges remain in implementing a workable fair-Earth-share Biocapacity strategy to which all of humanity adheres. These implementation challenges do not however diminish the value of the fair-Earth-share approach as a useful local-to-global sustainable-world testing method.

5.4. The generalisation-principle

The fourth test is based on the generalisation-principle (WCED 1987; Daly 1996). Within the Footprint-Analysis context, the idea is to consider if the use of K_{NR} by a unit of focus, and how this unit's behaviours might impact on K_{NR} use over time, is generalisable to all of humanity and for a sustainable-world outcome to still come about. If these are not generalisable then the unit of focus is not living sustainably.

The advantage of this approach is that, although the first three tests shown above are based on this generalisation concept, they are one-dimensional in nature. This fourth test opens for consideration a broader set of issues relevant to a local-to-global Footprint-Analysis assessment, particularly in relation to behaviours that may increase K_{NR} use, and/or erode the amount of available Biocapacity. For example, a nation might currently pass the fair-Earth-share test but, if it is also actively growing its population and eroding the fair-Earth-share Biocapacity value in the process, it may very well fail the generalisation test.

6. A sustainable-world – the local in terms of the global

This section overviews the application of the various concepts discussed so far to a local setting – South Australia – to assess it in terms of its contribution to, or detraction from, a global sustainable-world goal.

6.1. South Australia (SA): current Footprint-Analysis position

South Australia's (**SA's**) current Footprint-Analysis position is set out in Figures 5 and 6. Assessing these data in terms of the four tests described in section 4 shows the following:

(1) Consumption-based Ecological-Footprint vs local Biocapacity: South Australia's citizens, with an average Ecological-Footprint of 7.0ghpc, are currently not living within South Australia's Biocapacity limits after allowance is made for Biocapacity that is not available for human use (i.e., in the 3.8ghpc – 6ghpc range).

(2) Production-based Ecological-Footprint vs local Biocapacity: data on South Australia's production-based measure is not available so no conclusions can currently be drawn.

(3) Fair-Earth-share: South Australia's citizens, with an Ecological-Footprint of 7.0-ghpc, are living well beyond the global average Ecological-Footprint of 2.6-ghpc, and even further beyond a Biocapacity fair-Earth-share value which, based on the assumptions used in this paper, currently sits in the 0.9-ghpc to 1.4-ghpc range (see Figure 3).

(4) Generalisation test: in not meeting the consumption-based Ecological-Footprint and fair-Earth-share requirements, SA also fails the generalisation test, as the SA position in both of these respects is not generalisable to all.

Two of the South Australian Government's (**SAG's**) strategies that link directly to the current discussion will, however, also be considered in terms of the generalisation test, namely: (a) the SAG's population strategy, and (b) the SAG's Ecological-Footprint reduction target.

Figure 5: South Australia (SA) – current Footprint-Analysis data

Item	Value
Current average Ecological-Footprint for SA residents. #1	7.0 ghpc
Current average SA Biocapacity. #1	7.5 ghpc
Ecological-Footprint as a % of Biocapacity. #2	93%
1. Biocapacity – 20% unavailable for human use	
SA Biocapacity available for human use. #2	6.0 ghpc
Ecological-Footprint as a % of available Biocapacity. #2	117%
2. Biocapacity – 50% unavailable for human use	
SA Biocapacity available for human use. #2	3.8 ghpc
Ecological-Footprint as a % of available Biocapacity. #2	186%

Data sources:
#1: SAG (2006b)
#2: Author calculation.

Figure 6: South Australia (SA) – Footprint-Analysis data in the global context

Item	Value
1. Ecological-Footprint comparison – SA vs global	
Current average SA Ecological-Footprint.	7.0 ghpc
Current average global Ecological-Footprint.	2.6 ghpc
SA's Ecological-Footprint as a % of current global average Ecological-Footprint	269%
2. Ecological-Footprint and Biocapacity comparison – SA's Ecological-Footprint vs global Biocapacity	
Global average Biocapacity at 80% of current value.	1.4 ghpc
SA's current Ecological-Footprint as % of current global Biocapacity.	500%
Global average Biocapacity at 50% of current value.	0.9 ghpc
SA's current Ecological-Footprint as % of current global Biocapacity.	777%

Data source: Author calculation based on data in Figures 3 & 5.

6.2. The South Australian Government's (SAG's) population strategy

The SAG has in place a strategy to increase SA's population from the current (year 2010) figure of about 1.6m, to 2m by 2050 (SAG 2007c), although current trends suggest this target will be reached much sooner than the 2050 target date (SA-EDB 2007; SAG 2008a)). The 2m population target is however, not presented as an end point at which SA's population is planned to stabilise. There is a noted lack of stabilisation statements within the SAG's population policy narratives, with projections based around the 2m-by-2050 strategy indicating that by 2050, SA's population will still be growing (SAG 2006a).

The reasons presented by the SAG in support of its population strategy are multi-dimensional and include claims that an increased population is necessary to: (a) address social and economic problems that are expected to arise from the ageing profile of SA's population, (b) address the consequences of SA's below-replacement fertility rate that will, based on current trends, see a decline in overall population numbers in SA at some time in the future, (c) underpin SA's economic growth strategy to promote general wellbeing and prosperity for SA's citizens, and (d) maintain a critical population mass, relative to the population of other Australian states, to give meaningful influence to SA in negotiations at the national level (SA-EDB 2003; SAG 2004, 2007c).

To achieve this population growth, a range of strategies have been initiated by the SAG focused on: (a) increasing SA's fertility-rate (or at least, not allowing it to drop below a 1.7 babies-per-female level), (b) increasing immigration, and (c) reducing emigration (SAG 2004, 2007c). Although SA's current fertility rate – averaging about 1.7 over much of the 2000's period, increasing to about 1.95 in 2008 (SAG 2008b; ABS 2009a) – is below the long-term replacement rate of 2.1, the current SA social age structure still sees an increasing population from births alone. This is however expected to change in the future as SA's population ages (ABS 2009b), which will see net positive immigration needed to achieve the 2m-by-2050 target.

Whether the SAG's population policy is consistent with sustainable-world objectives is an arguable point. It is clearly not consistent with the Transformational approach which calls for a long-term population reduction strategy for which all nations need to play a part (see Appendix A – item 3.3(a)). For the Reformist approach however, the arguments are not quite so clear-cut. One view is that with SA having a below-replacement fertility rate, all the SAG's population policy is doing from a long-term perspective is moving people from one place on the planet to another, not adding to total global population. Although in SA current total births exceed deaths leading to fertility-based population increase, a below-replacement fertility rate will see this situation change with the passage of time. As such, the SAG's population policy may prove to be quite limited in its impacts in eroding the Biodiversity fair-Earth-share value. In this narrow sense, the SAG's approach can be interpreted as having some degree of consistency with the Reformist stabilisation approach to human population numbers (see Appendix A – item 3.3(a)). On the other hand, increasing the population in SA which has such a high per capita Ecological-Footprint (7.0-ghpc compared to the average for high-income nations of 6.1-ghpc – see Figure 2), may nonetheless increase SA's overall Ecological-Footprint impact if immigrants come from regions with a lower Ecological-Footprint value. The net effect may well be one of increasing the global aggregate Ecological-Footprint even if there is no net increase in global population numbers.

It is beyond the scope of this paper to explore the fine detail of the SAG's population policy but of key relevance to the current discussion is a point of principle, that the SAG views population growth as a necessary condition to further the wellbeing of SA's citizens, by both underpinning economic growth and, in more general terms, advancing the prosperity of the SA community. It is this fundamental belief in the benefits of population growth that raises concerns as to the generalisation of the SAG's approach. A strategy of long-term population growth to underpin human wellbeing and prosperity is challenging to reconcile with sustainable-world principles, and is a strategy that is not supported by either the Reformist or Transformational population narratives that are evident in the literature (see Appendix A – item 3.3(a)). The SAG, although acknowledging the sustainability challenges a growing population presents, nonetheless presents its population strategy as not only consistent with sustainable-world objectives, but in many ways beneficial to it (SAG 2004, 2006a).

6.3. The South Australian Government's (SAG's) Ecological-Footprint reduction target

The SAG seems to be aware that SA's Ecological-Footprint is unacceptably high, acknowledging that it is considerably higher than that of most other developed nations (SAG 2007c, b), considerably higher than the world average (SAG 2006b, 2007c), and "3.9 times higher" than current global-average available Biocapacity (SAG 2006b). The SAG also sees a reduction in SA's Ecological-Footprint as a key goal in order for SA to "attain sustainability" (SAG 2007c, 2008c). The Ecological-Footprint target the SAG has set for SA, as detailed in South Australia's Strategic Plan, is to reduce the aggregate SA Ecological-Footprint by 30% by the year 2050 (SAG 2007c). Based on the projected 2050 SA population of 2m (discussed above), this translates into a per capita SA Ecological-Footprint value by 2050 of 3.7-ghpc (a reduction of 47% from current levels). A summary analysis of this SAG target is shown as Figure 7.

Two key observations can be made from the Figure 7 data. Firstly, compared to projected 2050 SA Biocapacity levels (adjusting SA's current Biocapacity for population changes only), achieving the SAG's 2050 target would see SA's Ecological-Footprint reduce to be within local Biocapacity limits based on 80% of Biocapacity being available for human use. It will however still breach the 50%-availability-Biocapacity value. Secondly, compared to projected 2050 global Biocapacity, SA's per capita Ecological-Footprint would still be well in excess of a fair-Earth-share. Fair-Earth-share principles indicate that the SAG's Ecological-Footprint target should, based on the assumptions used in this paper, be in the 0.7-ghpc to 1.1-ghpc range. At 3.7-ghpc, SA's position will be far from this.

Figure 7: The South Australian Government (SAG**): Footprint-Analysis data projected to 2050**

Item	Value
1. Base data	
SAG's 2050 Ecological-Footprint target – average for all SA citizens. #1	3.7 ghpc
SA's projected Biocapacity in 2050 based on population change only - average for all SA citizens. #2	5.7 ghpc
2. SAG's 2050 Ecological-Footprint target compared to SA's 2050 Biocapacity available for human use	
SA's Biocapacity at 80% of 2050 value - average for all SA citizens. #2	4.6 ghpc
SA's 2050 Ecological-Footprint as a % of SA's 2050 Biocapacity at 80% value. #2	80%
SA's Biocapacity at 50% of 2050 value - average for all SA citizens. #2	2.9 ghpc
SA's 2050 Ecological-Footprint as a % of SA's 2050 Biocapacity at 50% value. #2	128%
3. SAG's 2050 Ecological-Footprint target compared to global 2050 Biocapacity available for human use	
Global average Biocapacity at 80% of 2050 value based on global population change only. #3	1.1 ghpc
SA's 2050 Ecological-Footprint as a % of SA's 2050 Biocapacity at 80% value. #2	336%
Global average Biocapacity at 50% of 2050 value based on global population change only. #3	0.7 ghpc
SA's 2050 Ecological-Footprint as a % of SA's 2050 Biocapacity at 50% value. #2	528%

Data source:
#1: SAG (2007c).
#2: Author calculation.
#3: Clifton (2010c).

6.4. Summary

The two key points to be made from the discussion in this section concerning SA's current Footprint-Analysis position, and the SAG's population growth and Ecological-Footprint reduction goals, are these.

Firstly, for the three tests described in section 5 for which data are available, SA's position is one of detracting from a global sustainable-world goal. In this respect, SA is a contributor to the Footprint-Analysis implications of current human behaviour as set out in Appendix B. The usefulness of the first test (consumption-based Ecological-Footprint limited to local Biocapacity) is debatable for this local-to-global analysis, although it does raise concerns of longer-term resource security for SA's citizens. The third (fair-Earth-share) and fourth (generalisation) tests are however, sufficient in their own right to support this detracting-from-the-global-goal claim. The absence of data for the second test (production-based Ecological-Footprint limited to local Biocapacity) is not critical to the conclusions drawn here, however the availability of this data would be useful to aid the SAG in its assessment of the impacts on the local K_{NR} base of production activities occurring within SA's borders.

Next is that the SAG's Ecological-Footprint reduction target, although having a 40-year time frame set for its achievement will, by the year 2050, see SA's citizens still living in ways inconsistent with a global sustainable-world objective. The idea of SA having a 2050 Ecological-Footprint in the range of 3 to 5 times greater than a fair-Earth-share (as per Figure 7) is quite troublesome. Serious consideration needs to be given to the implications of another 40 years passing by in which SA detracts from a global sustainable-world goal, and then continuing to do so even beyond this time.

7. Conclusion

This paper shows that, in Footprint-Analysis terms, humanity is currently living unsustainably. This unsustainable way of life has been evident, and progressively worsening, for well over 30 years, and is showing no signs of abating. But humanity has no choice but to live sustainably. Either it transitions to a sustainable-world in an orderly and peaceful way, or some form of imposed correction will, at some point, occur with consequences that may be far from desirable.

But how does any social group – such as a nation, a within-nation state, or a local community – know if it is living in ways consistent with a global sustainable-world goal? The purpose of this paper has been to explore this question and offer, through the use of Footprint-Analysis, one approach to conducting such an assessment. In doing so, the paper has sought to progress knowledge in this area in the following key ways.

Firstly, the analysis which is summarised as Appendix B shows how current global ecological-deficit and inequitable use of the Earth's renewable natural recourses (**K_{NR}**), as evident in the global Footprint-Analysis data, flows though to the broader range of dimensions shown in sustainable-world typology. This analysis provides additional understanding of the sustainable-world messages the Footprint-Analysis data projects.

Next, the paper has identified, and presented in a structured form in section 5, four tests by which local Footprint-Analysis data can be assessed. Such an assessment aids in gauging whether the consequences of human behaviour within a sub-global unit are, in Footprint-Analysis terms, contributing to or detracting from a global sustainable-world goal. The advantages of such an analysis include: (a) it provides a structured and objective testing framework that focuses on the consequences of local actions, measured in units (global hectares per capita) that can be directly referenced to the global context, and (b) accounts for the consequences of current K_{NR} use regardless of where in space and time these impacts might occur – this is particularly valuable as the full impact of local actions is often masked by the externalising of harms (as discussed in section 4.1). The key limitations in using this bank of tests however are: (a) a lack of clarity over exactly how much of the total available Biocapacity can be safely utilised by humans within the sustainable-world context, which impacts on the Footprint-Analysis data used in conducting the tests (for a detailed analysis of this issue, see Clifton (2010c)), and (b) uncertainties concerning some aspects of these tests; in particular, the usefulness of the first test (consumption-based Ecological-Footprint to be within local Biocapacity) is debatable, and application of the fair-Earth-share principle within the context of the Reformist sustainable-world approach is a little unclear. For both of these limitations, further research would be beneficial.

Overlaying these issues is another question to which this paper has not turned its attention, and that is how much K_{NR} is needed in order for humans to live flourishing lives. In section 4.2 it was noted that per capita Biocapacity that is expected to be available for human use by 2050 will be at a level that is currently being consumed by the citizens of only a handful of the least developed nations on Earth. For SA's citizens, with a current Ecological-Footprint of 7.0-ghpc, a reduction in Ecological-Footprint in the order of 85%-90% will be required to meet the 2050 fair-Earth-share Biocapacity value. This begs the question as to whether the current and projected human population can really achieve flourishing lives for all within available Biocapacity limits. Reformist advocates suggest it can. Transformational advocates suggest not, and propose that radical lifestyle changes, coupled with a long-term reduction in population, will be needed to achieve a sustainable-world outcome. This is a critical issue for which further research is needed.

Finally, the South Australian case study has added to existing knowledge through a practical application of Footprint-Analysis data to assess the local in terms of the global. The findings are particularly pertinent in this setting as the South Australian Government (**SAG**) holds itself out to be a sustainability leader (SAG 2007b, a). The Footprint-Analysis findings suggest however that the SAG needs to set and pursue a much more ambitious Ecological-Footprint reduction target to underpin its sustainability leadership claims.

What this paper has not addressed in relation to the SAG is whether its broader sustainable-world approach is a credible pathway to achieving the needed reduction in SA's Ecological-Footprint. The broader Project, on which this paper is based, does consider this issue in terms of the SAG's commitment to the Reformist paradigm. The findings from this critique of Reformism raise significant doubts as to whether this approach to a sustainable-world can ever see the primary sustainable-world goal achieved, regardless of how aggressively it is pursued (for a detailed discussion on this issue, see Clifton (2010c; 2010b)). If this finding is right, then the SAG will need to do much more than revise its Ecological-Footprint reduction target, as pursuit of the Reformist approach, to which the SAG is commitment, may by its nature make the needed reductions in SA's Ecological-Footprint unattainable.

Appendix A: Sustainable-world Typology (SWT)

Source: Clifton (2010a)

1. Dimensions: Sustainable-world (SW) Dimensions represented in the SWT are:

SWT Reference	SWT Dimension description
1.	**Primary Sustainable-world goal**
1.1.	Primary Goal
1.2.	Primary Goal area of focus
2.	**Space and time**
3.	**Satisfaction of interests**
3.1.	Interests: Scope
3.2(a).	Interests: Mechanism (human)
3.2(b).	Interests: Mechanism (non-human)
3.3(a).	Interests: Population (human)
3.3(b).	Interests: Population (non-human)
4.	**Responsibility**
4.1.	Cause
4.2.	Remedy

SWT Reference	SWT Dimension description
5.	**General principles and concepts**
5.1.	Modelling a SW – 3-Element Model
5.2.	Justice
5.3.	Human Interests - Resources
5.4.	Risk and Precaution
5.5.	Growth and Development
5.6.	Diversity
5.6.1.	Biodiversity
5.6.2.	Cultural diversity
5.7.	Security

2. The Sustainable-world typology

1. Primary Sustainable-world goal:		
1.1. Primary Goal	**Definitional:** The primary Sustainable-world goal is the flourishing of life on Earth over an indefinite time frame.	
1.2. Primary Goal area of focus	**Reformist**	**Weak anthropocentrism** • What is to be sustained is the flourishing of human life through the satisfaction of human Fulfilment Interests[#1] based on Considered Human Preferences [#2]. • The non-human world is only (or mostly) of instrumental value to humans in meeting Considered Human Preferences.
	Transformational	**Ecocentrism** • What is to be sustained is the flourishing of human and non-human life through the satisfaction of Fulfilment Interests. • Both human and non-human interests given consideration – humans interests do not take automatic preference.

Notes:

#1: Fulfilment Interests: are those things that are conducive to the flourishing of something (a person, a society, an animal, a plant, an ecosystem, etc.). These are high-order things which in the human context might include physical health, a sound mind, a sense of meaning and purpose in life and so on.

#2: Considered Human Preferences: are "*any desire or need that a human individual would express after careful deliberation, including a judgment that the desire or need is consistent with a rationally adopted world view*" (Norton 2003, p. 164), or, in the sustainable-world context, preferences consistent with a rationally adopted sustainable-world view.

2. Space and time: Definitional: A Sustainable-world is ultimately concerned with humans living sustainably at the global level over an indefinite time frame.

3. Satisfaction of interests: • Which needs (human and non-human) are to be met, and to what extent are they to be met, to satisfy these interests? (the Scope question). • How are these interests to be satisfied? (the Mechanism question). • For how many are these interests to be satisfied? (the Population question).		
3.1. Interests: Scope	**Reformist**	**Justice in meeting human needs and wants** • Justice in meeting human Fulfilment Needs[#3], then justice in meeting human wants[#4]. • Non-human species interest satisfaction based mostly, but not always, on their usefulness in satisfying human interests.
	Transformational	**Justice in meeting needs for all life** • First, justice in meeting Fulfilment Needs for humans and non-human species. • Then when achieved, justice in meeting human wants.

Notes:
#3: Fulfilment Needs: are those things that must be satisfied in order for Fulfilment Interests to be met - wholesome and adequate food for physical health, strong social relationships and family bonds for psychological health, etc.
#4: Human wants: are those things that go beyond fulfilment needs and are 'like to haves' but are not conditional for a flourishing life to be lived.

3.2(a). Interests: Mechanism (human)	**Reformist**	**Green and equitable consumerism** • Focus on consumerism with goods and services produced and consumed in environmentally responsible and socially just (green-and-just) ways. • Consumption that increases GDP for all of humanity is a fundamental social good.
	Transformational	**Sufficiency and life experiences** • Focus on non-material life experiences. • Consumption of goods and services based on sufficiency criteria. • Increased consumption needs of the poor are important and achieved through redistribution not more growth.
3.2(b). Interests: Mechanism (non-human)	**Reformist**	**Constrained to human parameters – Weak Anthropocentrism orientation** • Non-human life managed by humans mostly as natural resources for satisfaction of human Considered Preferences. • Supportive of technology-focused agricultural, including the use of GMOs and other intensive technology based crop and animal production, if done in green-and-just ways.
	Transformational	**Unconstrained flourishing – Ecocentrism orientation** • Humans manage themselves rather than managing Nature; a guiding principle of minimal interference so Nature can evolve and flourish in its own way. • Preference for organic agricultural, and an aversion to GMO technology and other intensive technology based crop and animal production.
3.3(a). Interests: Population (human)	**Reformist**	**Manage a SW to Population** • Population settles to a 'natural limit'. • Reduce very high rates of growth in some (mostly developing) nations. • Prevent reductions in some (mostly developed) nations. • Orientation to maximizing human population that can be sustained within SW criteria.
	Transformational	**Manage Population to a SW** • Current human population is unsustainable, and is an issue for all nations to address. • Long term reduction strategy required through collective non-coercive and non-discriminatory choice.
3.3(b). Interests: Population (non-human)	**Reformist**	**Constrained to human interests – Weak Anthropocentrism** • Non-human species diversity and population numbers mostly constrained to the extent needed to satisfy human instrumental objectives.
	Transformational	**Flourishing – Ecocentrism** • Non-human species flourish in their own right independently of human instrumental purposes or self-interest pursuit, characterised by abundance in biodiversity and in species population sizes. • Requires significant increases in population numbers for most species.

4. Responsibility:		
4.1. Cause	**Humans**: • Current SW problems are solely human society created problems. • Various social actors have contributed in different ways.	
	Reformist	**Wealth and Poverty, North and South** • Production and consumption patterns of the wealthy – especially in the North, poverty in the South, and a lack of development in the South, are key causes of ecological harm and SW problems generally.
	Transformational	**Wealth and North** • Production and consumption in the North, exploitation of the South by the North by both business and government, and efforts by the South to replicate Northern consumptive lifestyles, are the dominant causes of SW problems.
4.2. Remedy	**Humans**: • Humans are the only entity able to think about SW issues and to do something about them. • Within this human context, various social actors are claimed to have different remedial roles to play.	

	Reformist	**North and business led global green-and-just growth** • North to make its production and consumption more green-and-just and help the South develop sustainably. • South to embrace Northern economic ideals in green-and-just ways consistent with a Reformist SW view. • Business has a key role in promoting global growth in partnership with government, based on a Reformist SW view. • Individual responsibility to make green-and-just consumer choices.
	Transformational	**North restraint and sufficiency, South self determinism** • North to bring its production and consumption within fair Earth-share limits and to stop exploiting the South. • South to find its own way of living sustainably and without replicating the unsustainable ways of the North. • Business size and power constrained by government with a preference for the small and local. • Government policies to limit scale of resource consumption and of distributional inequality, and support wellbeing within these constraints based on Transformational principles. • Individual responsibility to adopt sufficiency lifestyles.

5. General principles and concepts		
5.1. Modelling a SW – the 3-Element Model	**Reformist**	**Interlocking circles / 3-legged-stool / 3-pillars** • Ecological, Social and Economic as separate but equally important and interrelated aspects of a SW. • No absolute limits to economic growth. • Allows trade-offs consistent with Weak Sustainability (see SWT item 5.3).
	Transformational	**Concentric circles** • Economy dependent on and constrained by Social, which is dependent on and constrained by Ecological.

5.2. Justice	**For all formulations of a SW** • Achieving both Intra-generational (IntraG) and Inter-generational (InterG) justice is a necessary condition for a SW. • Ultimately it is justice in outcomes that matter; any process approach to justice is only as good as the SW outcomes it produces. • Justice is considered in multi-dimensional terms including distribution (i.e. equity), recognition, capabilities, and participation.

	Reformist	**Human focused and growth based** • IntraG and InterG justice are relevant to humans only. • Overcoming poverty and achieving a more equitable distribution of wealth requires continued economic growth with the benefits of growth equitably shared. • InterG justice requires the passing on to future generations of an undiminished aggregate resource capital base (i.e., a Weak Sustainability approach – see item 5.3).
	Transformational	**Humans and Nature focused and redistribution based** • IntraG and InterG justice are relevant to humans and to human acts towards Nature. • Human resource consumption based on an equal 'fair-Earth share' entitlement through redistribution of wealth and resource use, especially from the North to the South and from humans to Nature, not through more economic growth. • InterG justice requires the passing on to future generations of independently undiminished natural (K_N) and human made (K_{HM}) capital bases (i.e., a strong sustainability approach – see item 5.3) based on ecocentric principles.

5.3. Human Interests – Resources	**Reformist**	**Weak Sustainability (WS)** • Sustainability requires the maintaining of the aggregate value of natural (K_N) and human forms (K_{HF}) of capital. • Capital types are substitutable beyond minimum critical values.
	Reformist and Transformational features	**Strong Sustainability (SS) – Weak Anthropocentrism orientation** • Sustainability requires K_N and K_{HF} to be maintained separately. • K_N and K_{HF} are mostly complements and only marginally substitutable.

	Transformational	**Strong Sustainability (SS) – Ecocentrism orientation** • SS reconstructed to incorporate ecocentric principles. • K_N as Nature rather than as merely a human resource. • K_{HF} incorporates values beyond it being a form of capital.

5.4. Risk and Precaution	**Reformist**	**Risk Management** • Maximisation and optimisation of human activity. • Risks from human activity are managed mostly through application of science and weaker forms of Precautionary Principle (PP). • Risk aversion to change in social systems and institutions beyond marginal change consistent with Reformist principles.
	Transformational	**Resilience Living** • Socio-ecological Resilience Living pursued instead of human activity strategies oriented to maximisation and optimisation. • Stronger forms of the PP, and use of broad forms of knowledge in addition to scientific, are also utilised to address risk. • Risk tolerant of fundamental change to social systems and institutions to see primary SW goals achieved.

5.5. Growth and Development	**Reformist**	**Sustainable Growth** • Human wellbeing, including elimination of poverty and resolution of ecological problems, achieved through green-and-just, unlimited, and global GDP growth supported by free-trade, market based SW incentives, and a key role for the business sector. • Technology and human ingenuity as keys to resolving problems caused by growth and to overcome limits to growth
	Transformational	**Qualitative Development and Sufficiency** • Human wellbeing progressed through green-and-just qualitative development and consumptive sufficiency, achieved through a steady-state economy, internationalisation not globalization, and a preference for consumption from local production. • Continued consumptive growth not sustainable or possible, and is a cause of ecological problems and of poverty.

5.6. Diversity	**For all formulations of a SW** Both biodiversity and cultural diversity are seen under all SW Diversity Perspectives as being interdependent, mutually supportive, and necessary and equally important for there to be a SW.

5.6.1. Biodiversity	**Reformist**	**Constrained to human (weak anthropocentric) interests** • Biodiversity loss inevitable and acceptable but not below levels consistent with weak anthropocentrism. • Consistent with mono-culture industrial agricultural including the precautionary use of GMO technology.
	Transformational	**Flourishing** • Biodiversity as a fundamental good. • Humans need to live in ways that are biodiversity enhancing. • Sceptical of mono-culture industrial agricultural and use of GMO technology. • Advocates a return to high diversity organic agricultural practices.
5.6.2. Cultural diversity	**Reformist**	**Constrained within dominant socio-economic system** • Cultural diversity encouraged but exists within a dominant Reformist SW approach based on globalization, free trade, GDP growth, and a green-and-just consumer culture. • Incorporates concepts of multiculturalism, protection of indigenous rights, protection of items of cultural heritage and language, and the commodification of cultural goods and services.
	Transformational	**Flourishing** • Cultural diversity as a fundamental good incorporating all aspects of human society including economic systems. • Humans need to live in ways that are cultural diversity enhancing.

<table>
<tr><td rowspan="3">5.7. Security</td><td>Reformist</td><td rowspan="2">Human Security focus
• Focus on broad issues of Human Security and root causes of insecurity.
• Peace Dividend applied to progressing human and ecological wellbeing objectives.</td><td>Targeted disarmament
• General reductions in military spending.
• Non-proliferation of, and elimination of, some types of weapons, especially weapons of mass destruction (WMD).</td></tr>
<tr><td>Reformist and Transformational features</td><td>Broad scale disarmament
• Disarmament to minimal non-provocative defence capability; no WMD.
• Stronger peace keeping capacity under international control.</td></tr>
<tr><td>Transformational</td><td colspan="2">Life Security focus
• Focus on broad issues of security for humans and non-human species, and addressing root causes of insecurity.
• Peace Dividend applied to progressing SW objectives consistent with transformational principles.
• Broad scale disarmament approach.</td></tr>
</table>

Appendix B: Footprint-Analysis – a global perspective and SWT critique

Note:

BioC = Biocapacity	*K_{NR} = Renewable natural capital*
CHB = Current Human Behaviour	*RA = Reformist Approach*
EF = Ecological-Footprint	*SW = Sustainable-world*
FA = Footprint-Analysis	*TA = Transformational Approach*

SW-Dimension	Footprint-Analysis assessment
1. Primary goal of a Sustainable-world	
1.1. Primary Goal	a) CHB is inconsistent with the Primary SW 'Flourishing of Life' goal (reasons are detailed in the other SW-Dimensions shown below).
1.2. Primary Goal area of focus	a) Weak-anthropocentrism requirement (for both the RA and TA) • CHB is inconsistent with the weak-anthropocentric requirement of both the RA and TA. • Depletion of K_{NR} stocks as a result of current and persistent ecological-deficit, plus the inequitable use of BioC, is inconsistent with the Considered Human Preferences requirement of weak-anthropocentrism, as it breaches a number of the SW requirements of both the RA and TA (these are detailed below for the various SW-Dimensions). b) Ecocentric requirement (for the TA) • CHB is inconsistent with the ecocentric requirement of the TA. • Depletion of K_{NR} stocks as a result of current and persistent ecological-deficit is inconsistent with the ecocentric principle of the flourishing of both human and non-human life. c) Conclusion: FA shows CHB to be inconsistent with both the RA and TA.
2. Space and time	a) CHB that results in current and persistent ecological-deficit is inconsistent with the primary SW goal of 'flourishing life over an indefinite time frame'. b) Although short-term ecological-deficit is not necessarily inconsistent with a longer term SW goal (Pearce & Atkinson 1998; Lamming, Faruk & Cousins 1999), standard FA data shows ecological-deficit commencing around 1980 (Footprint Network 2009) or, based on allowances for BioC not available for human use, from at least around 1960, with the degree of ecological-deficit increasing constantly since then. This is challenging to accept as merely a short term anomaly. c) Conclusion: FA shows CHB to be inconsistent with both the RA and TA 'indefinite time frame' requirement.
3. Satisfaction of interests	
3.1. Interests: Scope	a) Cross nation FA data show significant inequity in K_{NR} use. • On its own, these data do not show whether some of humanity has too little, more than is needed, or the right amount of K_{NR}, in order to lead flourishing lives. • The data instead show that if a more equitable use of available K_{NR} is in fact needed in order for Fulfilment Needs to be met for all of humanity, then this is not occurring and in that case, both the RA and TA would be breached. • Other data shows that the current state of the world is one where some do not have vital needs adequately met whilst others have more material goods than is needed to lead flourishing lives (Rees 2008; Tansey & Rajotte 2008; Bell 2009). As such, the FA data provides one measure of the degree of this injustice. b) For the TA approach, the current ecological-deficit position, and the resulting degrading of K_{NR} stocks, breaches the justice obligation for the meeting of Fulfilment Interests for non-human species. c) Conclusion: FA data supports other data showing that CHB has a consequence of some of humanity not having Fulfilment Needs met whilst others are having both Fulfilment Needs and Wants met, breaching both the RA and TA. The TA requirement for meeting Fulfilment Needs of non-human species is also being breached.
3.2(a). Interests: Mechanism (human)	a) Current and persistent ecological-deficit, and inequity in BioC use, breaches the green-and-just requirements for resource consumption under both the RA and TA. b) Conclusion: FA shows CHB to be inconsistent with both the RA and TA.
3.2(b). Interests: Mechanism (non-human)	a) FA shows that CHB breaches at least some aspects of the RA, as the way humans are 'managing' non-human life by way of persistent ecological-deficit is inconsistent with the Considered Human Preferences obligation (as per item 1.2 above). b) FA shows that CHB breaches at least some aspects of the TA, as persistent ecological-deficit is inconsistent with the notion of humans managing their own behaviour in respect of how the Earth's K_{NR} is treated, and is inconsistent with the requirement that nature is treated on a 'minimal interference' basis. c) Beyond this, FA data do not shed any light on agricultural practices for either the RA or TA. d) Conclusion: FA shows CHB to be inconsistent with a number of aspects of both the RA and TA.
3.3(a). Interests: Population (human)	a) FA does not show whether current human population numbers are inherently unsustainable or if it is possible for current numbers to live sustainably in either RA or TA terms (although the TA claims that it is not able to do so). b) FA does show that the requirement for the current human population to live in ways consistent with SW criteria is not being met and, as such, breaches both the RA and TA.

	c) Conclusion: FA shows, for both the RA and TA, CHB to be inconsistent with the requirement for the current population to live in accordance with SW criteria. FA does not show whether or not it is realistically possible for the current human population to live in ways consistent with either the RA or TA.
3.3(b). Interests: Population (non-human)	a) FA does not show if human use of the Earth's K_{NR} has breached critical levels although if this has not yet happened, continued ecological-deficit as is evident in the FA data suggests that this will occur unless the ecological-deficit status is remedied. b) Other data sources suggest that in some areas, critical K_{NR} levels have in fact been breached (e.g. Rockström et al (2009)). c) Current and persistent ecological-deficit breaches the flourishing of non-human life requirement of the TA. d) Conclusion: FA shows CHB to be inconsistent with both the RA and TA

4. Responsibility	
4.1. Cause	a) On a per-capita basis: • High-income nations have the highest EF and one that is above global average BioC and, in this respect, are the primary contributors to depletion of K_{NR} stocks. This is consistent with both the RA and TA. • Middle-income nations also have an EF in excess of global average BioC and in this respect are also net contributors to depletion of K_{NR} stocks, but at a rate well below that of the richest nations. • Low-income nations are the lest problematic although they may too be using K_{NR} at a rate that cannot be generalised to all (this is based on low-income nations having an average EF of 1ghpc vs. average global BioC available for human use in the 0.9 ghpc to 1.4 ghpc range. b) On an aggregate basis: • High-income nations and middle-income nations are both major K_{NR} consumers, with middle-income nations collectively the highest. • Generalisation of high-income nation lifestyles to all of humanity is not possible, which is consistent with the TA. Generalisation of middle-income nation lifestyles to all of humanity, and for there to also be a SW outcome, is also not possible. Even the K_{NR} use of low-income nations may not be generalisable to all. c) Conclusion: FA data is consistent with some aspects of both RA and TA narratives as to who is responsible for the current (un)SW problems. FA however does not provide data to address all of the RA and TA issues shown for this SW-Dimension.
4.2. Remedy	a) Of the list of parties shown in the SWT item 4.2., FA data is only directly relevant to behaviour in the nation-context, although extension to considering remedy responsibilities to other parties is possible. b) At the national level, FA shows that: • High-income and middle-income nations need to reduce their per capita EF in order for it to be generalisable to all of humanity. High-income nations need to make the most significant reductions. This is consistent with both the RA and the TA, although these two approaches see the needed actions to achieve this EF reduction in substantially different ways. • High-income nations alone cannot bring the aggregate global EF within global BioC limits: middle-income nations also need to act. c) Social actors shown in SWT item 4.2 (government, business, individuals): • As a nation's total EF is the aggregate of consumption activities by all social actors, each has a role to play in reducing the nation's EF. • FA does not show the extent of action any of these parties needs to take, although it does show the need for such action. d) Conclusion: FA is consistent with some aspects of both RA and TA narratives as to who is responsible for remedying the current (un)SW problems. FA however does not provide data to address all of the RA and TA issues shown for the SW-Dimension.

5. General principles and concepts		
5.1. Modelling a SW – the 3-Element Model	a) b) c)	This SW-Dimension has to do with how a SW is pictured and as such, the FA data is of limited application. FA does however show that CHB is inconsistent with the concentric-circles model (that is, humanity is not living within surrounding ecosystem constraints), although such a clear-cut comparison with the interlocking circles model is not evident from the FA data. Conclusion: FA has limited application for this SW-Dimension, although it does show that CHB is inconsistent with the concentric circles model.
5.2. Justice	a) b) c) d) e)	FA is concerned with use of K_{NR} and in this respect is of particular relevance to the distributional limb of the SW Justice Dimension. FA shows considerable inequity within the current generation in K_{NR} consumption that is inconsistent with both the RA and TA views of fairness in resource use (see item 3.1 above). The condition of persistent ecological-deficit also breaches intergenerational justice obligations through depletion of K_{NR} stocks which put at risk the ability of future generations to live flourishing lives. Ecological-deficit also impacts on non-human species and as such, breaches the TA ecocentric obligation of justice by humans towards non-human species. Conclusion: FA shows CHB to be inconsistent with the distributional limb of justice for both the RA and TA.
5.3. Human Interests - Resources	a) b) c)	Ecological-deficit erodes K_{NR} stocks and in this respect, is inconsistent with strong-sustainability and in particular, with the ecocentric formulation of strong-sustainability as applies for the TA . Continued ecological-deficit, as is currently evident, also must at some point erode K_{NR} stocks to the point where critical levels are breached, which is inconsistent with weak-sustainability (see item 3.3(b) above). Conclusion: CHB is inconsistent with both the RA and TA.
5.4. Risk and Precaution	a) b) c)	Current and persistent ecological-deficit is inconsistent with the Precautionary Principle in either its weak (RA) or strong (TA) forms, as it shows a failure to take the needed action to address this cause of human and ecosystem harm. Ecological-deficit is inconsistent with the 'resilience living' requirement of the TA as it does not keep K_{NR} use well within available BioC limits. Conclusion: FA shows CHB to be inconsistent with some aspects of both the RA and the TA.
5.5. Growth and Development	a) b) c) d)	FA shows that humanity is increasing its use of K_{NR} – it is consuming more in the way of resource throughput. In this respect, growth as resource-throughput is shown in the FA data to be continuing. Ecological-deficit and inequality in this consumption of BioC breaches the green-and-just criteria of the RA. Growth in K_{NR} through-put breaches the 'sufficiency' and 'qualitative growth' TA criteria, as this criteria requires human Fulfilment Interest satisfaction to be achieved by using K_{NR} within available BioC limits. Conclusion: FA shows CHB to be inconsistent with both the RA and the TA.
5.6. Diversity 5.6.1. Bio-diversity	 a) b) c)	 Persistent and increasing ecological-deficit means K_{NR} stocks are being depleted, which impacts directly on non-human species. • Although 'K_{NR} stock depletion' does not mean the same thing as 'species loss is occurring', it is challenging to see K_{NR} stock depletion as producing any result other than biodiversity loss. • Data from other sources showing that the 'sixth great global species extinction event' is in progress, this one caused by humanity (Pretty 2007), is consistent with this view of ecological-deficit impact as driving biodiversity loss. • This is a breach of the TA requirement for humans to live in ways that are biodiversity enhancing. FA does not show if ecological-deficit has breached RA 'critical levels' (the weakest RA test) although other evidence suggests it has (see item 3..3(b) above). Continued ecological-deficit will eventually result in critical levels being breached and in this sense, maintaining current FA trends is a breach of the RA. Conclusion: FA shows CHB to be inconsistent with both the RA and the TA.
5.6.2. Cultural diversity	a) b) c) d) e)	FA does not offer direct evidence of CHB impacts on cultural-diversity. It does however, show an indirect impact via the link between biodiversity and cultural-diversity where: • Biodiversity and cultural-diversity are mutually supportive. • Biodiversity loss is one driver of cultural-diversity loss. This biodiversity-loss impact on cultural-diversity is inconsistent with the TA objective of humanity living in ways that are cultural-diversity enhancing. The link to the RA cultural diversity objective is not clear. Conclusion: FA shown CHB to be inconsistent with the TA approach, but the link to the RA approach is unclear.

5.7. Security	a)	Ecological-deficit and inequitable use of K_{NR} shown by the FA data impact on security issues in a number of ways including: • Human-security (RA): breaches the 'freedom from want' (Archer 2005; UN 2005) criteria of human security.

	• Life security (TA): breaches the human-security criteria and the non-human-species-security criteria (Davion 2004) of the TA. • Degrading of K_{NR} stocks undermines the security interests of future generation (for humans and non-human species) which is also inconsistent with the RA and TA intergenerational justice principle (see item 5.2 above). • Ecological-deficit is linked to increasing competition for K_{NR}, (WWF 2006; Footprint Network 2008) and this form of resource competition is seen as one driver for increasing conflict and military capacity (Archer 2005; Diamond 2005) as nations seek to secure needed K_{NR} and protect their own K_{NR}. This conflict and militarism pressure is inconsistent with both the RA and TA. • Inequality in access to and use of resources is itself a driver of conflict (Gould, Pellow & Schnaiberg 2008). b) FA shows many nations with an EF in excess of local BioC. For these nations, the security of their own citizens is put at risk in the sense that meeting the needs of its citizens can only be achieved if other nations are willing and able to supply K_{NR}, or if the nation is willing to erode its own capital base which is itself an unsustainable way of life. This erosion of human security is inconsistent with both the RA and TA (Wackernagel & Yount 1998; Footprint Network 2008). c) Conclusion: FA shows CHB to be inconsistent with the TA and RA.

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ENVIRONMENTAL MANAGEMENT ACCOUNTING: AN EMPIRICAL INVESTIGATION OF MANUFACTURING COMPANIES IN MALAYSIA

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Abstract

Environmental management practices and the implementation of environmental management systems (EMS) have spurred interest in the adoption of environmental management accounting (EMA). EMA integrates environmental information with economic information. Through EMA, the accounting systems will explicitly identify, generate, analyze and use financial and non-financial environmental related information. This paper offers a review of the literature regarding EMA adoption followed by a survey report. The study also explores the associations between EMA, environmental performance and economic performance. To test the proposed relationships, a survey questionnaire was administered to accountants and environmental managers of manufacturing companies in Malaysia. The results of correlation analyses support the hypothesized relationships.

Introduction

Of late, a great deal of interest has been focused on the relation between business activities and environmental issues (Christmann & Taylor 2001). As companies are now expected to be more environmentally responsible, an increasing number of companies worldwide are putting in place environmental management systems as part of their efforts towards better environmental management (Graff 1997; Melnyk, Sroufe & Calantone 2003). In 1996, the International Organization for Standardization (ISO) introduced the ISO14001 environmental management systems specification-certification standards to aid companies in developing and implementing the environmental management systems. By December 2008, the number of ISO14001 certificates issued worldwide had increased to 188,815, revealing a leap of 22 percent from the previous year (ISO 2008).

Accordingly, an adequate accounting system that considers both environmental and economic impacts is important in assisting companies' to fulfill their environmental management tasks (Burritt, Hahn & Schaltegger 2002). Thus, some companies have started to develop integrated and complete management accounting systems, specifically taking into account the environmental impacts of their activities. Environmental management accounting allows for a better integration of the environmental information into the existing accounting systems. As it explicitly treats environmental costs and tracks environmental information, EMA highlights hidden environmental costs and benefits (Votta, Kauffman & White 1998; Jasch 2003; De Palma & Csutora 2003; Jasch & Lavicka 2006; Staniskis & Stasiskiene 2006). Nevertheless, little is known about EMA since the prior studies are dominantly prescriptive, often focusing on one specific EMA tool or managerial aspect of the organization. The purpose of this article is threefold: to introduce environmental management accounting (EMA), empirically examine the extent manufacturing companies in Malaysia implement EMA, and describe its benefits in terms of environmental and economic performance. The rest of the paper is structured as follows. The second section discusses the literature review while the third section focuses on the research method. The findings are then discussed in the results section.

1. Literature Review

EMA is an integral part of management accounting that assists in the accounting for environmentally-related management initiatives (Jasch 2006a). According to the International Federation of Accountants (IFAC 1998, para. 1):

> EMA is the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves life-cycle costing, full-cost accounting, benefits assessment, and strategic planning for environmental management.

Information generated through EMA can either be in monetary or physical terms. Correspondingly, the United Nations Division for Sustainable Development (UNDSD 2001, p. 1) states that:

> The general use of EMA information is for internal organizational calculations and decision making. EMA procedures for internal decision making include both: physical procedures for material and energy consumption, flows and final disposal, and monetarized procedures for costs, savings and revenues related to activities with a potential environmental impact.

Through EMA, both monetary and physical environment related information are identified, collected and analyzed for decision making and other purposes including external reporting (UNDSD 2001; Deegan 2003; IFAC 2005). The financial procedures, known as monetary environmental management accounting (MEMA), reflect the environmental impact affecting the economic systems of the company and are measured in monetary value. While, the physical procedures, known as physical environmental management accounting (PEMA), reflect the impact of an organization’s activity on the environmental systems and are measured in physical value (Burritt, Hahn & Schaltegger 2002). Both parts of the EMA (MEMA and PEMA) systems incorporate environmental information into various strategic and operational activities of the company (Schaltegger, Burritt & Petersen 2003) and support its internal management systems (Schaltegger & Burritt 2000).

Monetary Environmental Management Accounting (MEMA)

The MEMA systems are actually an extension of conventional management accounting systems. In the MEMA systems, management accounting tools are used to track, trace and treat costs and revenue incurred in relation to the company’s impact on the environment (Schaltegger & Burritt, 2000). For example, in MEMA, product costing covers a broader scope, which involves the tracing of direct and indirect environmental costs such as costs of permits and fees and recycling of products. Another example of MEMA is the consideration of environmentally induced revenues such as profit contributions from producing greener products (Langfield-Smith, Thorne & Hilton 2009). In summary, MEMA provides the link between a company’s environmental-related activities with its past, present and future financial stocks and flows. Through MEMA, strategic and operational planning will include the environmental aspects of the company's activities. As a result, decision making will involve environmental related targets and achievements. Additionally, the MEMA systems also act as a control and accountability device (Schaltegger & Burritt 2000).

Physical Environmental Management Accounting (PEMA)

The PEMA systems account for the ecological impact pertaining to a company's activities in physical units such as kilowatt hours, decibels, kilograms and tonnes. In the PEMA systems, consideration is given to information regarding the use, flows and destinations of energy, water, materials and wastes (Langfield-Smith, Thorne & Hilton 2009). Similar to the MEMA systems, PEMA boosts ecological sustainability by highlighting environmental related information. Through PEMA, the ecological strengths and weaknesses of the company are clearly highlighted. Consequently, this will lead to better measurement and control of environmental quality and consequences. Furthermore, information provided by the PEMA systems promotes transparency, specifically on the environmental related activities of the company (Schaltegger & Burritt, 2000).

EMA, Environmental Performance, Economic Performance

There are various environmental and economic benefits that come with EMA adoption. EMA generates more precise information on environmental impact (Staniskis & Stasiskiene, 2006). Staniskis and Stasiskiene (2006), when examining the current state of EMA in 150 companies in Lithuania, found that material and energy tracking for product costs and waste streams is essential in supporting the implementation of environmental management systems and cleaner production (CP) innovations. Information gathered from the tracking enables companies to integrate material intensities in the decision making processes, and consequently conduct appropriate cost allocation, capital investment, and process/product design. Through EMA, a more accurate evaluation on the effectiveness of proposed or implemented environmental related actions can be obtained (Staniskis & Stasiskiene 2006).

EMA provides measurements on the logical consequence of change relative to costs and benefits of environmental actions. By linking material purchase value to non-product output (Jasch 2003), EMA provides the much needed financial view of environmental impact. For example, the material flow accounting monitors and associates the flow of energy, water and materials with the generation of waste, emission and sold products (Jasch 2006b). Here, the impact of business activities on the environmental systems and economic conditions of the company is explicitly recognized.

When there is a clearer link between business activities and environmental costs, the management will be able to identify potential cost savings from environmental abatement activities (Schaltegger & Figge 2000). In terms of bottom line, EMA justifies the link between environmental impacts and financial statements. Information on environmental costs provided by the accountants can function as a starting point for environmental managers to shape the environmental measurement systems, provide the foundation for environmental reporting and suggest options to improve material efficiency (Jasch & Lavicka 2006). Similarly, the accountants, when faced with difficulties while dissecting environmental information, may use the information provided by the environmental managers to assist in their financial analysis (Jasch & Lavicka 2006).

Furthermore, EMA highlights hidden environmental costs by revealing its source and location (Jasch 2003). Such exposure will bring about improvement in terms of environmental cost control and investment (DePalma & Csutora 2003). For instance, a case study by Votta, Kauffman and White

(1998) found that the exposure of hidden environmental costs stimulates more efficient cost management where the company is able to reduce scrap costs, inventory turnover time and purchase order cycle time.

The abovementioned literature suggests that EMA adoption can be linked to better environmental and economic performance. Nevertheless, these studies are dominantly prescriptive, concentrating on the implementation and development of a particular type of EMA tool. In the present study, EMA adoption is examined via a questionnaire survey, taking into consideration a broad array of MEMA and PEMA tools. As such, the following hypotheses are developed:

Hypothesis 1. There is a positive relationship between the level of EMA (MEMA and PEMA) adoption and environmental performance.

Hypothesis 2. There is a positive relationship between the level of EMA (MEMA and PEMA) adoption and economic performance.

2. Research Method

Study Sample

Data was collected using a mail questionnaire survey sent to 1,069 manufacturing companies randomly selected from the Federation of Malaysian Manufacturers Directory 2006 (FMM 2006). Two sets of questionnaires were prepared. The first focuses on MEMA while the second set focuses on PEMA. Set I was sent to accountants, given that they have a responsibility for environmental-related financial measures of the company's activities. Meanwhile environmental managers were chosen as respondents for questionnaire set II because of their role concerning the company's impact on the environment (Schaltegger, Burritt & Petersen 2003).

Of the 1,069 questionnaires distributed to each group of respondents, 86 were received from accountants and 104 from environmental managers (a response rate of 8 percent and 9.7 percent, respectively). The low response rate is inevitable since EMA, despite being a relevant research area, is an emerging issue in Malaysia. Twelve accountants and 5 environmental managers did not complete the questionnaire. Additionally, 11 sets of responses (environmental managers) were identified as outliers. Thus, 74 and 88 responses were used in the data analysis. Next, the 'time-trend extrapolation test' was carried out to ensure that the responses are free from non-response bias.

Table 1 illustrates the background information of the companies that have participated in the survey including their sectors, ownership, EMS certification, allocation of budget for research and development (R&D) on environmental matters.

Table 1 - Demographic profile of respondents

Description	Range	*Cos *Set I Freq (%)	*Cos *Set II Freq (%)
Sector of operation	Chemical/ wood	14 (18.9)	22 (25)
	Plastic, rubber/ metal	16 (21.6)	11 (12.5)
	Electrical/ electronics	6 (8.1)	21 (24)
	Automotive/ machinery	5 (6.8)	4 (4.5)
	Building materials	4 (5.4)	8 (9)
	Food/ tobacco	8 (10.8)	4 (4.5)
	Others	15 (20.3)	11 (12.5)
	No information	6 (8.1)	7 (8)
	Total	74 (100)	88 (100)
Ownership	Malaysian	42 (56.8)	0 (0)
	Non-Malaysian	24 (32.4)	32 (36.3)
	Joint ownership	7 (9.5)	38 (43.2)
	Missing	1 (1.4)	18 (20.5)
	Total	74 (100)	88 (100)

EMS certification	Yes	25 (33.8)	46 (52.3)
	No	44 (59.5)	25 (28.4)
	Planning to have	5 (6.8)	16 (18.2)
	Missing	0 (0)	1 (1.1)
	Total	74 (100)	88 (100)
Budget for R&D on specifically environmental related matters	Yes	15 (20.3)	25 (28.4)
	No	59 (79.7)	61 (69.3)
	Missing	0 (0)	2 (2.3)
	Total	74 (100)	88 (100)

**Cos- companies, ; *Questionnaire Set I *Questionnaire Set II*

Measurements

EMA

Similar to Frost and Wilmshurst (2000), and Burritt, Hahn and Schaltegger (2002), the present study measures EMA adoption from a broad perspective. Based on Burritt, Hahn and Schaltegger's (2002) comprehensive EMA framework, a checklist of EMA tools was prepared to gather information on EMA adoption. For each of the thirteen MEMA items (as listed in Table 2) the respondents were asked to indicate their agreement, on a scale of 1 (none at all) to 5 (very much), on the undertaking of the respective MEMA tools in their organization.

Table 2 - MEMA items

- environmental cost accounting
- environmentally induced capital expenditure and revenue
- post assessment of relevant environmental costing decisions
- environmental lifecycle costing
- environmental target costing
- post investment of individual environmental projects
- monetary environmental operational budgeting
- monetary environmental capital budgeting
- environmental long-term financial planning
- relevant environmental costing
- monetary environmental project investment appraisal
- environmental lifecycle budgeting
- environmental lifecycle target pricing

Similarly, for each of the 11 PEMA items (as listed in Table 3), the respondents were asked to indicate their agreement, on a scale of 1 (none at all) to 5 (very much), on the undertaking of the respective PEMA tools in their organization.

Table 3 - PEMA items

- material flow assessment
- energy flow assessment
- environmental capital impact assessment
- post assessment of short-term environmental impact
- lifecycle inventories
- post investment assessment of physical environmental investment appraisal
- physical environmental budgeting
- long-term physical environmental planning,
- relevant environmental impacts
- physical environmental investment appraisal,
- lifecycle analysis

Environmental performance

The present study identifies environmental performance from the scope of pollution control efficiency. This approach is similar to the approach taken by Spicer (1978); Jaggi and Freedman (1992); Stanwick and Stanwick (1998); Wagner et al., (2002); Al-Tuwaijri, and Wagner and Schaltegger (2004). Environmental performance is defined as the achievement in terms of environmental related company impact (Wagner & Schaltegger 2004). On a scale of 1(no) to 5(very much), and following Wagner and Schaltegger (2004), the respondents were asked to evaluate parts of their company's environmental performance as listed in Table 4.

Table 4 - Environmental performance items

- reduction in the use of water
- reduction in the use of energy
- reduction in the use of non-renewable resources
- reduction in the use of toxic inputs
- reduction of solid waste
- reduction of soil contamination
- reduction in waste water emissions
- reduction in emissions to air
- reduction of noise
- reduction of smell/odour emissions
- reduction of landscape damage
- reduction in the risk of severe accidents

Economic performance

The present study views economic performance from the scope of environmental competitiveness. Environmental competitiveness refers to that part of overall corporate competitiveness and economic performance of the company, which is created and influenced by environmental management (Wagner & Schaltegger 2004). Consistent with Wagner and Schaltegger (2004), sixteen items (as listed in Table 5) were initially used to represent economic performance. The respondents were requested to evaluate these items, in relation to their company's recent performance, on a scale of 1(very low) to 5(very high).

Table 5 Economic performance items

- competitive advantage
- corporate image
- product image
- sales
- market share
- new market opportunities
- short-term profit
- long-term profit
- cost savings
- productivity
- insurance conditions
- access to bank loans
- owner/shareholder satisfaction
- management satisfaction
- worker satisfaction
- recruitment and staff retention

3. Results

Reliability and validity test

The present study employs factor analysis via principal component analysis (PCA) to estimate construct validity. Next, the Cronbach's alpha reliability estimates were performed on the items extracted from the PCA.

EMA

Table 6 shows that the PCA resulted in the identification of only one construct of MEMA explaining 79.138 percent of the variance. The Cronbach's Alpha is 0.978. The PCA also resulted in the identification of only one construct of PEMA explaining 75.128 percent of the variance. The Cronbach's Alpha is 0.967.

Environmental performance

For the first set of questionnaires (for the accountants), the PCA identified two components as the constructs that measure environmental performance. The first component was named 'reduction of negative environmental impact' and the second component was termed 'reduction in usage of natural resources'. Both components, as listed in Table 7, explain 73.379 percent of the variance for the variable, environmental performance. One item (reduction in risk of severe accidents) was dropped from the analysis because of low factor loading and cross loading problems. The Cronbach's Alpha values for reduction of negative environmental impact and reduction in usage of natural resources are 0.946 and 0.807, respectively.

For the second set of questionnaires (for the environmental managers), the PCA (as presented in table 7) identify two components as the constructs that measure environmental performance. The first component is called 'reduction of negative environmental impact' and the second component 'reduction in usage of natural resources'. The components explain 63.568 percent of the variance for the variable environmental performance. The Cronbach's Alpha values for reduction of negative environmental impact and reduction in usage of natural resources are 0.911 and 0.803, respectively.

Economic performance

For the first set of questionnaires (for the accountants), the PCA (as presented in Table 8) results in identification of three factors of economic performance. The first component is named 'internal stakeholders' satisfaction' since it mainly reflects the satisfaction of the corporate internal party. The second component is termed 'business benefits' since it relates to benefits concerning business activities. The third component is termed 'future benefits'. These three components explain 65.4 percent of the variance for variable economic performance. Six items (market share, short-term profit, cost savings, productivity, improved insurance conditions, better access to bank loans) were dropped from the analysis because of low factor loading and cross loading problems. The Cronbach's Alpha values for internal stakeholders' satisfaction, business benefits and future benefits are 0.793, 0.790 and 0.560, respectively.

Table 6 - PCA on EMA

QUESTIONNAIRE SURVEY I – MEMA		**QUESTIONNAIRE SURVEY II – PEMA**	
Items and description	**1 MEMA**	**Items and description**	**1 PEMA**
Relevant environmental costing.	0.950	Post assessment of short-term environmental impact (e.g. of a site or product).	0.904
Environmental lifecycle budgeting.	0.940	Environmental (or natural) capital impact assessment.	0.887
Monetary environmental project investment appraisal.	0.925	Post investment assessment of physical environmental investment appraisal.	0.883
Environmental long-term financial planning.	0.914	Physical environmental investment appraisal.	0.874
Environmental lifecycle costing.	0.907	Material flow assessment (short-term impact on the environment, i.e. product, site, division, and company levels).	0.874
Environmental lifecycle target pricing.	0.901	Energy flow assessment (short-term impact on the environment, i.e. product, site, division, and company levels).	0.872
Environmental target costing.	0.901	Lifecycle analysis of specific project.	0.861
Monetary environmental capital budgeting.	0.898	Relevant environmental impacts (e.g. given short run constraints on activities).	0.856
Monetary environmental operational budgeting.	0.896	Long-term physical environmental planning.	0.844
Post assessment of relevant environmental costing decisions.	0.892	Lifecycle inventories.	0.843
Post investment assessment of individual projects.	0.858	Physical environmental budgeting (flows and stocks) (e.g. material and energy flow activity based budgeting).	0.829
Environmentally induced capital expenditure and revenue.	0.800		
Environmental cost accounting.	0.763		

For the second set of questionnaires (for the environmental managers), the PCA (as shown in table 8) resulted in the identification of three factors of economic performance labelled as 'security' (component 1), 'business benefits' (component 2) and 'reputation' (component 3). These three components explain 55.248 percent of the variance for variable economic performance. Three items (management satisfaction, owner satisfaction and sales) were dropped from the analysis due to low factor loading and cross loading problems. The Cronbach's Alpha values for security, business benefits and reputation are 0.793, 0.724 and 0.676, respectively.

Adoption of MEMA

The results in table 9 show that the MEMA adoption level is low (mean score 2.329). It seems that the role of accounting is not perceived as important in supporting the environmental management systems of the companies, particularly in ensuring environmental related efficiency (Wilmshurst & Frost 2001).

Table 7 PCA on Environmental Performance

QUESTIONNAIRE SURVEY I (MEMA) - ENVIRONMENTAL PERFORMANCE			QUESTIONNAIRE SURVEY II (PEMA) - ENVIRONMENTAL PERFORMANCE		
Items and description	**1 Reduction of negative environmental impacts**	**2 Reduction in use of non-renewable resources**	**Items and description**	**1 Reduction of negative environmental impacts**	**2 Reduction in use of non-renewable resources**
Reduction of soil contamination	0.892		Reduction in wastewater emissions	0.849	
Reduction in wastewater emissions	0.886		Reduction in emissions to air	0.827	
Reduction in emissions to air	0.884		Reduction of smell/odour emissions	0.818	
Reduction of smell/odour emissions	0.861		Reduction of noise	0.800	
Reduction of solid waste	0.781		Reduction of soil contamination	0.794	
Reduction of landscape damage	0.780		Reduction in the risk of severe accidents	0.760	
Reduction of noise	0.755		Reduction of landscape damage	0.729	
Reduction in use of toxic inputs	0.665		Reduction in use of toxic inputs	0.613	
Reduction in use of non-renewable resources		0.871	Reduction of solid waste	0.560	
Reduction in use of energy		0.841	Reduction in use of energy		0.877
Reduction in use of water		0.713	Reduction in use of water		0.855
			Reduction in use of non-renewable resources		0.746

Nevertheless, the accountants do feel that their companies are performing moderately in terms of environmental performance (reduction of negative environmental impact – mean score 3.433; and reduction in usage of natural resources – mean score 3.225). The accountants also believe that their companies are performing well in terms of economic performance (internal stakeholders' satisfaction – moderate mean score 3.432; business benefits – high mean score 3.776; and future benefits – high mean score 3.574).

Pearson correlation analysis was used to assess the relationships among critical variables. The correlation results (see Table 11) show that there is a significant positive relationship between MEMA adoption and environmental performance (reduction of negative environmental impact, reduction in usage of natural resources). The relationship between MEMA adoption and economic performance (business benefits, future benefits) are also significant and positive.

Adoption of PEMA

The mean score for PEMA (i.e. 3.056 see Table 10) suggests that the respondents believe their PEMA adoption level is moderate. Thus, there appears to be a moderate involvement of environmental managers in supporting the management accounting systems of the organization. As indicated by their mean scores, the respondents feel that they are doing well in reducing their negative environmental impact (mean score high at 3.610) and usage of natural resources (mean score moderate at 3.314).

Table 8 PCA on Economic Performance

QUESTIONNAIRE SURVEY I (MEMA) - ECONOMIC PERFORMANCE				QUESTIONNAIRE SURVEY II (PEMA) - ECONOMIC PERFORMANCE			
Items and description	**1 Internal stakeholders' satisfaction**	**2 Business benefits**	**3 Future benefits**	**Items and description**	**1 Security**	**2 Business benefits**	**3 Reputation**
Owner/ shareholder satisfaction	0.805			Improved insurance conditions	0.772		
Recruitment & staff retention	0.761			Better access to bank loans	0.698		
Management satisfaction	0.739			Productivity	0.681		
Worker satisfaction	0.736			Recruitment & staff retention	0.679		
Product image		0.834		Worker satisfaction	0.605		
Corporate image		0.832		Long-term profit		0.819	
Competitive advantage		0.681		Market share		0.682	
Sales		0.565		Competitive advantage		0.628	
Long-term profit			0.834	New market opportunities		0.606	
New market opportunities			0.751	Short-term profit		0.568	
				Corporate image			0.818
				Product image			0.756
				Cost savings			0.603

Similarly, the respondents also perceive that their recent performance is good in terms of security (mean score high at 3.531), business benefits (mean score high at 3.564) and reputation (mean score high at 3.792).

Next, the correlation analysis (see Table 12) shows that there is a significant positive relationship between PEMA adoption and environmental performance (reduction of negative environmental impact, and reduction in usage of natural resources). The relationship between PEMA adoption and economic performance (security, business benefits, reputation) is also significant and positive. Therefore, if the level of EMA (MEMA and PEMA) adoption increases, based on the sample of companies examined, environmental performance also increases. Similarly, if the level of EMA (MEMA and PEMA) adoption increases, environmental performance also increases. The correlation results support hypotheses 1 and 2.

Table 9 Descriptive statistics- questionnaire survey set I

Variables	Actual Range		Mean	Med	S.D.
	Min	Max			
MEMA	1.00	5.00	2.329	2.308	1.014
Environmental Performance:					
Reduction of negative environmental impact	1.00	5.00	3.433	3.375	0.886
Reduction in usage of natural resources	1.67	5.00	3.225	3.333	0.769
Economic performance:					
Internal stakeholders'satisfaction	2.00	5.00	3.432	3.500	0.624
Business benefits	2.50	5.00	3.776	3.750	0.605
Future benefits	2.00	5.00	3.574	3.500	0.706

Med= Median

Table 10 Descriptive statistics- questionnaire survey set II

Variables	Actual Range		Mean	Med	S.D.
	Min	Max			
PEMA	1.00	5.00	3.056	3.182	0.969
Environmental Performance:					
Reduction of negative environmental impact	1.22	5.00	3.610	3.722	0.789
Reduction in usage of natural resources	1.33	5.00	3.314	3.333	0.671
Economic performance:					
Security	2.00	5.00	3.531	3.600	0.557
Businessbenefits	2.20	5.00	3.564	3.600	0.525
Reputation	2.67	5.00	3.792	3.667	0.526

Med= Median

Conclusion

This study describes EMA (MEMA and PEMA) adoption among manufacturing companies in Malaysia. At present, there is still a paucity of EMA research in developing countries such as Malaysia. The results suggest that the adoption of EMA is not at an encouraging level. The low adoption of MEMA and the moderate adoption level of PEMA signal the likelihood that the manufacturing companies in Malaysia may view EMA as a less significant aspect of their internal management system. Additionally, the accountants, when compared with the environmental managers, seem to be more reluctant in incorporating EMA as part of the organizations' management systems.

Nonetheless, the results also show that there are significant positive correlations between the EMA adoption level and environmental performance. Positive correlations are also observed between the EMA adoption level and economic performance. Therefore, it is suggested that the adoption of EMA improves environmental and economic performance. Although the adoption level of both MEMA and PEMA is still disheartening, both the accountants and environmental managers do relate EMA adoption with better environmental performance and economic performance. This point reflects the awareness of both parties of the potential role of EMA in bringing about better performance.

As a newly developed area, empirical investigation on EMA is still understandably sparse. The present study offers a more comprehensive study of EMA by taking into account the two distinct dimensions of EMA, which are MEMA and PEMA. Such an approach is advantageous as it allows for better identification concerning the engagement of both the accountants and environmental managers in their company's EMA adoption.

Table 11 - Correlation matrix- questionnaire survey set

	MEMA	Red in neg env impact	Red in usage of nat res	Internal s/holder satisfactn	Bus benefits	Future benefits
MEMA	1.000					
Reduction of negative environmental impact	0.329**	1.000				
Reduction in usage of natural resources	0.406**	0.539**	1.000			
Internal stakeholders satisfaction	0.158	0.294**	0.446**	1.000		
Business benefits	0.409**	0.408**	0.410**	0.492**	1.000	
Future benefits	0.206*	0.225*	0.221*	0.377**	0.393**	1.000

**significant at 0.01 level (2-tailed)
*significant at 0.05 level (2-tailed)

Table 12 - Correlation matrix- questionnaire survey set II

	PEMA	Red in neg env impact	Red in usage of nat res	Security	Bus benefits	Reputatn
PEMA	1.000					
Reduction of negative environmental impact	0.399**	1.000				
Reduction in usage of natural resources	0.232*	0.409**	1.000			
Security	0.352**	0.479**	0.186**	1.000		
Business benefits	0.259**	0.315**	0.320**	0.449**	1.000	
Reputation	0.343*	0.458*	0.369*	0.519**	0.385**	1.000

**significant at 0.01 level (2-tailed)
*significant at 0.05 level (2-tailed)

Accountants play a major role in the development of the company's management accounting systems while the environmental managers carry the responsibility concerning the environmental management systems of the company.

Furthermore, the findings provide some evidence concerning the impact of EMA in enhancing both environmental and economic performance. In other words, EMA demonstrates great potential for eco-efficiency. As companies worldwide are now facing the increasing challenge to align their businesses' core values and competencies with corporate responsibility (Othman 2009, p. 23 (cited in Arshad et. al. 2009)), both accountants and environmental managers may want to move forward by optimizing the utilization of EMA.

Future research may consider a case study based assessment of EMA adoption. Through case studies, the researcher will be able to achieve a more in-depth exploration by closely examining the link between EMA adoption, environmental and economic performance. Another research avenue is the investigation concerning communication between the accountants and environmental managers, particularly in relation to the MEMA and PEMA information tools.

Finally, the results of this study must be interpreted with some caution. As the research variables were measured through the perceptions of the respondents, it is likely that there will be some leniency error (higher mean values in the observed score). This is consistent with human nature and that is to overemphasize the positive quality or performance of the organization that they represent. Objective measures of performance such as return on investment and return on assets may capture performance more accurately (Gul, 1991). Further, because of time and cost constraints, the data gathered was collected at a single point of time, inheriting the usual limitations of cross-sectional data.

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ENVIRONMENT EXTRA!

Biodiversity threat to business is bigger than climate change

The threat from the decline in biodiversity should be viewed as larger and more urgent to business than climate change.

That is one of the conclusions made by professional services firm PricewaterhouseCoopers (PwC), which has contributed to the business perceptions of the risk posed by **biodiversity** loss to a major UN study launched in London today.

PwC analysis shows less than one in five companies, including many UK household names, see biodiversity as an important business issue.

The Economics of Ecosystems and Biodiversity (TEEB) is a two-year study led by the UN Environment Programme and funded by the European Commission and Governments including Germany, Norway and the UK. It examines the economics of biodiversity and ecosystem loss for business arguing that businesses have an economic interest in protecting nature and, in some cases, should see it as opportunity for new activity.

The UN defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".

Biodiversity is decreasing at an alarming rate, however. Since 1970, 30 per cent of the animal population has become extinct, while the coverage of living corals has reduced by 40 per cent.

The global economic impact of biodiversity loss is estimated at between £1-3 trillion annually or up to 7.5 per cent of global GDP.

"Nature biting back"

Speaking at the first Global Business of Biodiversity symposium in London, where today’s report was launched, PwC said UK business needed to prepare for "nature biting back".

"Current business strategies and plans in the UK are biting the hand that feeds stable consumer prices, business prospects and long term investor security and returns," said Malcolm Preston, CEO, sustainability and climate change, PwC.

PwC warned no UK sector or business will escape unaffected by changes and availability of biodiversity and ecosystem 'services’. Such services include water used in food and drink production, timber for packaging, furniture and paper, productive land for fruit and vegetables, and fibres for clothes.

Asset base

Jon Williams, partner, sustainability and climate change at PwC, said businesses should start viewing ecosystems as "an extension of their asset base" as the scrutiny of big business and its impacts on the world’s 'natural capital’ is likely to intensify as better evaluations and assessments come to the fore.

"The UK’s access to, and use of environmental resources in locations from local farms in Suffolk to rainforests in south America, is like an international warehouse of assets that no-one has priced or got an inventory for," he said.

Blind spots

PwC highlights five blind spots’ for UK businesses to focus on when it comes to biodiversity. These include corporate reporting to reflect changes to how resources are considered for the business’s future; unpredictability in supply chain pricing and availability; greater awareness among consumers about biodiversity loss, leading to changes in consumer preferences and purchasing decisions; investors factoring in more value for resources that supply and sustain businesses and funds they are investing in, and new environmental regulation, tax and subsidy reforms taking into account biodiversity.

Source 13th July 2010 Greenwise Business: http://www.greenwisebusiness.co.uk/accounting.aspx

International Integrated Reporting Committee (IIRC) formed to pursue sustainability accounting framework

The Prince of Wales's Accounting for Sustainability Project (A4S) and the Global Reporting Initiative (GRI) have announced the formation of the International Integrated Reporting Committee (IIRC). The IIRC aims to create a globally accepted framework for accounting for sustainability, bringing together financial, environmental, social and governance information an "integrated" format.

Purpose of the IIRC

The IIRC is being created to respond to the need for a concise, clear, comprehensive and comparable integrated reporting framework structured around the organisation's strategic objectives, its governance and business model and integrating both material financial and non-financial information.

The objectives for an integrated reporting framework are to:

- support the information needs of long-term investors, by showing the broader and longer-term consequences of decision-making
- reflect the interconnections between environmental, social, governance and financial factors in decisions that affect long-term performance and condition, making clear the link between sustainability and economic value
- provide the necessary framework for environmental and social factors to be taken into account systematically in reporting and decision-making
- rebalance performance metrics away from an undue emphasis on short-term financial performance, and
- bring reporting closer to the information used by management to run the business on a day-to-day basis.

Role of the IIRC

The role of the IIRC is to:

- raise awareness of this issue and develop a consensus among governments, listing authorities, business, investors, accounting bodies and standard setters for the best way to address it
- develop an overarching integrated reporting framework setting out the scope of integrated reporting and its key components
- identify priority areas where additional work is needed and provide a plan for development
- consider whether standards in this area should be voluntary or mandatory and facilitate collaboration between standard-setters and convergence in the standards needed to underpin integrated reporting and promote the adoption of integrated reporting by relevant regulators and report preparers.

The IIRC brings together a cross section of representatives from civil society and the corporate, accounting, securities, regulatory, NGO, IGO and standard-setting sectors.

Source: 3rd August 2010 Integrated Reporting: www.integratedreporting.org

UK's largest companies still not measuring carbon footprint

Despite the threat of increased legislation, most of the UK's largest companies do not currently measure their carbon footprint, a survey has found.

Three quarters (74 per cent) of finance heads from UK companies with more than 500 employees said their companies have not yet measured their carbon footprint in a poll published by the Carbon Trust.

Nearly half (48 per cent) did not have a clear corporate target for carbon reduction and a further 16 per cent did not know if their company had a target.

This is despite the fact that most of the 200 finance heads surveyed said they anticipated all businesses will be required to measure their carbon footprint (72 per cent) and pay a price for the carbon they emit (76 per cent) within the next decade (59 per cent).

The findings were published just weeks before the registration deadline for the Carbon Reduction Commitment (CRC) Energy Efficiency Scheme, the Government's cap and trade scheme designed to improve the energy efficiency in large, low energy-intensive organisations not already covered by the UK Climate Change Agreements and the European Union Emissions Trading System. Around 5,000 large public and private sector organisations, such as supermarkets, water companies, banks and local authorities, will need to purchase carbon allowances to cover their emissions from April 2011 under the scheme. However, Government figures show that less than half of those organisations required to register for the scheme, have so far done so.

"The debate about whether or not carbon footprinting and payment will become mandatory for business appears to be over as far as finance heads are concerned," commented Harry Morrison, general manager of the Carbon Trust Standard Company, which offers independent certification for businesses that measure, manage and reduce their carbon emissions. "Yet only a minority have taken action so far and these early movers have a clear advantage. Building carbon management into the DNA of the business now not only ensures preparedness for future compliance requirements but also brings immediate cost and efficiency benefits and competitive edge."

The survey was conducted among finance decision-makers in six key sectors – retail, professional services, financial services, technology and communications, fast moving consumer goods (FMCG) and leisure and entertainment.

Low carbon opportunities

While more than a third (43 per cent) of those interviewed believed the low carbon economy provided an opportunity for their business, there were marked differences in outlook between industries. The majority of technology and communications organisations (88 per cent) and FMCG companies (63 per cent) viewing the low carbon economy as an opportunity. However that figure was much lower among professional services (22 per cent) financial services (30 per cent) and retailers (31 per cent).

Low carbon drivers

When asked what the drivers were for their companies' switchover to a low carbon economy, most of those surveyed cited increased efficiency and reduced costs by reducing energy use (97 per cent), complying with carbon legislation (95 per cent), meeting customer (78 per cent) and employee expectations (76 per cent) and protecting corporate reputation (74 per cent). Less than half (48 per cent) believed it would create new market opportunities or win business. Meanwhile, less than half (45 per cent) of all respondents cited investor expectation as important, but this figure almost doubled among finance heads at technology and communications companies (88 per cent).

"About half of businesses appear to be on the front foot, seeing the business development opportunities in the low carbon economy rather than simply reacting to legislative requirements and cost incentives," said Morrison.

Rachel Sinha, sustainability manager, Institute of Chartered Accountants of England and Wales (ICAEW) said it was important for finance heads to play a role in "guiding" their organisations' carbon management strategy. "They, therefore, need to be prepared to provide the evidence base and framework for their organisations to be able to turn this time of change into a competitive advantage."

Source 16th August Greenwise Business: http://www.greenwisebusiness.co.uk/accounting.aspx

CALLS FOR PAPERS

Forthcoming for 2011

The **8th Spanish Conference on Social and Environmental Accounting Research**: University of Burgos, Spain, 2011.

Discussions also underway for a **joint EMAN/CSEAR conference in Northern Europe/Scandinavia** during 2011.

The 1st French CSEAR conference will be held between June 13th - 14th in 2011 and the venue will be the Université Paris Dauphine in Paris. Further details to come.

Source: CSEAR website, St Andrews University: http://www.st-andrews.ac.uk/~csearweb/conferencesnews/other-csear.html

Climate and Environmental Governance Network (CEGNet):
Governance for Green Growth?
25 February 2011
Expression of interest/proposed title:
30 September 2010
Abstract: 30 October 2010
Full Papers: 30 January 2011

The current structure of the global economic system lies at the heart of many debates about environmental sustainability. Decades of impressive economic growth have left their marks on the Earth's oceans, landscapes, rivers and atmosphere, raising the question of whether recent trends are sustainable.

One response to this question, arising in the aftermath of the Global Financial Crisis (GFC), is the suggestion that the tension between economic growth and environmental sustainability can be resolved though "Green Growth".

According to proponents of the concept, Green Growth emphasizes environmentally sustainable economic progress to foster low-carbon and socially inclusive development. For example, the 2009 OECD Declaration on Green Growth stated that "a number of well targeted policy instruments can be used to encourage green investment in order to simultaneously contribute to economic recovery in the short-term, and help to build the environmentally friendly infrastructure required for a green economy in the long-term". Other observers agree that more investment in green sectors is needed and that such investment can boost employment; however, they question the continued emphasis on 'growth', at least in developed economies.

A move towards Green Growth (or, more radically, to 'steady state' economics) will not be achieved without reforms and innovations in governance at the local, national and global level. This workshop aims to explore the institutions and regulatory strategies that have been proposed or have emerged in recent years to facilitate the transition to a green economy.

The workshop will bring together researchers from Australia and New Zealand who will present formal papers and contribute to informal discussions. We are negotiating for a selection of the papers to be published as a Special Issue of *Environmental Policy and Governance* (ERA level B journal). Financial support will be made available to speakers coming from inter-state.

We would like to invite paper proposals that fit within one of the following three themes:

1. Global governance for green growth?

This session will explore the institutions and regulatory strategies for green growth that have been proposed or have emerged at the global level. For example, the United Nations Environment Programme (UNEP) has put forward a proposal for a global 'Green New Deal' which includes recommendations for reforming the governance of international trade, aid and finance. What is the potential for international cooperation in these areas, particularly post-Copenhagen? Which global forum is most suitable for fostering such cooperation – the UN, G8, G20?

2. National and local governance for green growth?

This session will explore the institutions and regulatory strategies for green growth that have been proposed or have emerged at the national and local levels. For example, in the wake of the GFC many governments, particularly in developed countries, introduced Keynesian stimulus packages that had a strong emphasis on 'green' measures that simultaneously tackled unemployment and issues such as energy efficiency. How successful have such initiatives been? Is there anything distinctive about government strategies in Australia, New Zealand or other countries in Asia and the Pacific? To what extent can local governments and communities play a role in the transition to a green economy?

3. Private governance for green growth?

This session will explore the institutions and regulatory strategies for green growth that have been proposed or have emerged in the private sector. The business community clearly has a strong interest in how a green economy would be governed. What role do public-private partnerships, co- and self-regulation and corporate social responsibility play in governance for green growth?

To submit a proposed title or abstract please email Neil.Gunningham@anu.edu.au
For other enquiries please email Christian.Downie@anu.edu.au

** This workshop is endorsed by the Earth System Governance project (www.earthsystemgovernance.org) and has received financial support from the College of Asia and Pacific, Australian National University.*
