This is the Accepted Version of a paper in Attwater, R. & Merson, J. (eds) (2007), "Sustaining our social and natural capital: Proceedings of the12th ANSYS Conference". 576 pp. ISBN: 978-0-9791688-8. ISCE Publishing, Mansfield, MA. Reference URLs updated, and minor changes made, in 2012.

Giving shape and structure to the mess of sustainability accounting

Dick Osborn
PhD Researcher

Australian National Centre for the Public Awareness of Science
Physics Link Building 38a, Science Road
ANU College of Medicine, Biology and Environment
ANU College of Physical and Mathematical Sciences
The Australian National University, Canberra, ACT 0200
Australia

Email: dick.osborn@anu.edu.au.

Acknowledgements
Comments from an anonymous reviewer on an earlier draft are gratefully acknowledged, as are those from Sue Stocklmayer and Leonie Pearson. The paper remains a work-in-progress. Further suggestions are most welcome.

Abstract
Pidd (1996) defines a mess as an unstructured situation where disagreement exists as to what needs to be done and why. This work-in-progress establishes sustainability accounting as a mess. Transmitting new ideas on sustainability from a mess is unlikely to achieve positive responses from receivers. Combining secondary data on well-known sustainability accounting tools with the Innovation Adoption Curve is used to test this proposition. Adoption rates of ISO 14001 and the Global Reporting Initiative's Guidelines cannot reach the critical mass interval on the Adoption Curve within any reasonable planning horizon. The adoption rate for Local Agenda 21 is significantly higher. Three hierarchical models are then aligned to offer a structure for going beyond the messy consequences from past initiatives in sustainability accounting. Daly's capitals hierarchy is aligned with an Australian hierarchy of communities-of-place, and with the UN's hierarchical classifications of human, natural, and built capital stocks.

This is the Accepted Version of a paper in Attwater, R. & Merson, J. (eds) (2007), "Sustaining our social and natural capital: Proceedings of the12th ANSYS Conference". 576 pp. ISBN: 978-0-9791688-8. ISCE Publishing, Mansfield, MA. Reference URLs updated, and minor changes made, in 2012.

1. Introduction

This work-in-progress argues for simplifying the communication and organisational learning tasks of managing for sustainability transition. It advocates decision-makers monitor progress within their community-of-place by assessing change in its capital stocks, doing so across multiple levels with existing measures and institutional arrangements. Argument is presented in the following three sections.

Section 2 uses a definition from management science to establish the collective efforts in sustainability accounting over past decades as a mess. Widespread behavioural change towards sustainability seems unlikely when messages promoting its accounting practices are transmitted from a mess. Section 3 supports this proposition by providing examples of progress along the Adoption Curve for popular innovations in sustainability accounting. Resolving the mess and its consequences is essential, since managing for sustainability transition depends on engaging most, if not all, decision-makers (eg Carver 2001; Walker et al 2002; Backstrand 2003; Siebenhuner 2004). Section 4 identifies integrated assessment of change in a place's capital stocks as an effective means to engage many decision-makers, and to transmit information across the multiple levels of sustainability governance. Three existing hierarchical models are aligned to give shape and structure to the mess of sustainability accounting. Their alignment and application reduces the complexity, and therefore organisational learning tasks, of managing for sustainability transition.

2. Establishing sustainability accounting as a mess

A mess is an unstructured situation where disagreements exist on what needs to be done and why, and therefore where it is impossible to say how it should be done (Pidd 1996). Giving shape and structure precedes resolving a messy situation (Richey 2002; Mackenzie et al 2006). Two entry points seem useful for the mess considered here: a definition of accounting that accommodates the interests of accountants and non-accountants; and establishing when the communication of new ideas on sustainability accounting began. Two channels are used to connect transmitter and receiver in establishing a mutual understanding on the worth of new ideas: interpersonal channels and mass media channels (Rogers1995: 17-18). Here, considering when sustainability accounting began must rely on evidence from transmitters using mass media channels.

Peskin (1998: 376) defines accounting as providing decision-makers at household, business, and government levels with a "structured body of information, where movements in a system's inputs and outputs during an accounting period are described relative to its state of balance." Peskin applies this definition to financial accounting, and to accounting for environmental sustainability.

The US National Erosion Reconnaissance Survey of 1934 (Natural Resources Conservation Service 2001) meets Peskin's accounting definition. It is a structured body of information describing the extent and nature of imbalances in a land use system. Its pioneering methods were repeated in Australia a decade later (Rural Reconstruction Commission 1944), and have been adopted and adapted since by many agencies. A research literature on social and environmental accounting practice in the corporate sector began in the early 1970s (Mathews 1997). In 1973, the US Water Resources Council (WRC) mandated selected federal agencies apply common principles and accounting standards when evaluating and reporting proposals for water and land-related projects. The US 1973 WRC regulations require the construction of four accounts: national economic development, environmental quality, regional economic development, and social well-being (Water Science and Technology Board 2004). Some member countries in the OECD (including Australia) compiled and published State-of-Environment-Reports in the 1970s (OECD 1979).

This is the Accepted Version of a paper in Attwater, R. & Merson, J. (eds) (2007), "Sustaining our social and natural capital: Proceedings of the12th ANSYS Conference". 576 pp. ISBN: 978-0-9791688-8. ISCE Publishing, Mansfield, MA. Reference URLs updated, and minor changes made, in 2012.
The evidence presented above thus shows communicating innovations in sustainability accounting from designers to practitioners through mass media channels began some 40-70 years ago; at multiple levels of decision-making, and using both physical and monetary metrics. Even so, significant disagreements as to the why and what of sustainability accounting practice remain. Examples include:

- *It [the sustainability debate] is prone to inclusive political correctness and the accounting profession should not attempt to respond to all the different agendas and expectations. (Institute of Chartered Accountants in England and Wales 2002) v. There are no other binding commitments remotely achievable at the World Summit on Sustainable Development that could be more valuable than a commitment to creating the means to authoritatively assess progress to sustainable development. (Hales and Prescott-Allen 2002).*
- *At the heart of accounting is the measurement of financial transactions which are transfers of legal property rights made under contractual relationships. Non-financial transactions are specifically excluded due to conservatism and materiality principles.(Wikipedia 2006) v. The task of the accounting profession in relation to intangible assets and knowledge-based enterprise is less about counting than it is about giving an account – telling the story of both tangible and intangible assets in meaningful ways, for both managers and markets. (Lambe 2002).*
- *Correct accounting is good economics and good economics accounts correctly….Green accounting does not provide a method for accounting for sustainability and cannot be massaged, manipulated or extended to do so. (Cairns 2006) v. Sustainability accounting desegregates the internal accounts to show costs and benefits relating to economic, social, and environmental performance. It also extends the accounting boundary to consider the monetary value of external impacts. (Forum for the Future 2003).*
- *Developing and using information on environmental performance and conditions is critical to any environmental management framework and must be incorporated at all levels of decision-making. There is a need to develop, agree upon, and apply common metrics for measuring and reporting environmental performance of products, households, services, firms, facilities and the economy .(President's Council for Sustainable Development 1999). v. 675 tools applicable to the assessment of sustainability in urban development were identified, with 165 of these undergoing evaluations against a set of criteria identified as important for the integrated assessment of urban sustainability. Additionally, stakeholders, including urban decision-makers and tool developers were canvassed on the strengths and weaknesses of current assessment tools and future user requirements. The results of this work confirmed that there is no tool currently capable of simultaneously covering all assessment criteria. (Walton et al 2005).*

3. Using the Innovation Adoption Curve to illustrate the mess's consequences.

The research field of innovation diffusion began in 1903 (Rogers 1995: 39-40). It now contributes, for example, to evidence-based policy and practice (Nutley et al 2002); and to policy design for dealing with complex adaptive systems (Rogers et al 2005). Progress in adopting accounting innovations can be estimated by combining a generic Innovation Adoption Curve with secondary data on the number of adopters, and on the number of decision-making units at saturation point (Osborn *et al* 2002).

3.1 The generic Innovation Adoption Curve

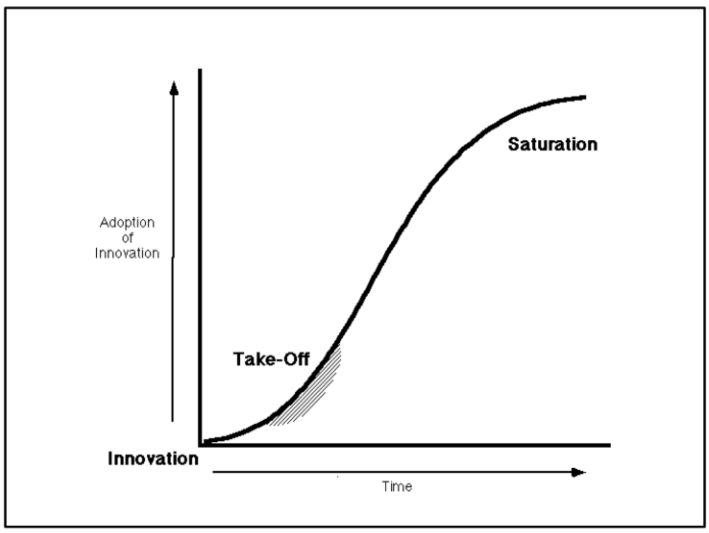
The cumulative rate at which decision-makers adopt innovations within a given social system generally follows an S-curve over time (Rogers 1995:11). The take-off interval on the generic curve (Figure 1) is predicted to occur when some 10-20% of all decision-makers within the social system under

consideration have adopted the innovation. Original work on the strength of weak ties by Granovetter (1973) provides the basis for this prediction, and for much of present understanding on how social networks operate. For example, Granovetter's work has popular acceptance through Gladwell's (2000) description of epidemic diffusion thresholds.

3.2 Mandatory versus voluntary adoption in the US

The generic Innovation Adoption Curve of Figure 1 illustrates the cumulative rate of adoption over time where the decision made to adopt or reject an innovation is voluntary. Adoption can also occur through

Figure 1: The Innovation Adoption Curve



Source: Adapted from Rogers (1995)

an authority-innovation decision (Rogers 1995: 28-30). Political judgements within a social system determine the extent and nature of adopter engagement following an authority-innovation decision.

Differences between mandatory and voluntary innovation adoption provide one illustration of consequences from the mess of sustainability accounting. Figure 2 shows adoption by US establishments of two sustainability accounting practices. Trends in adoption rates are expressed relative to the known number of establishments at the Innovation Curve's saturation point. Some differences between the two practices are as follows:

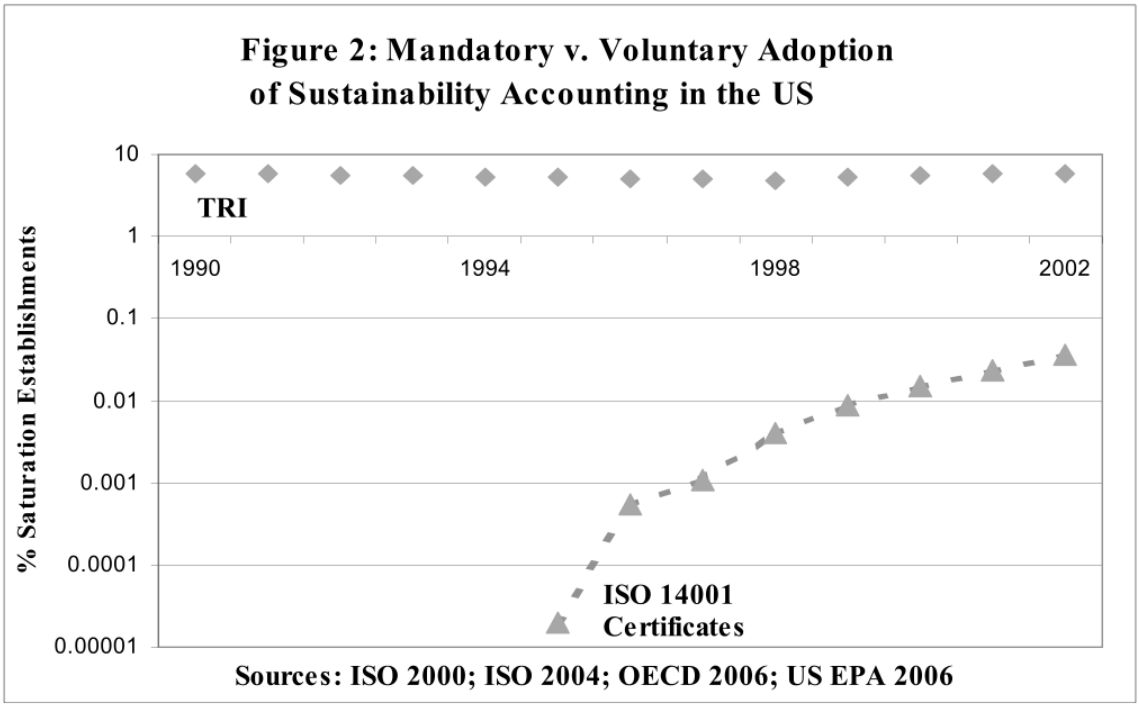
1. The Toxic Release Inventory (TRI) Program began in 1987 as a response to the Bhopal disaster (US EPA 2006). Establishments operating above specified thresholds within the manufacturing, oil refinery, and public utilities industries are required to disclose their location coordinates, plus provide data on their release of specified toxic chemicals and other wastes. Establishment numbers within targeted industries declined slightly from 410,000 to 400,000 during 1990-2002 (OECD 2006). Of these, close to 6% qualified each year in that interval as TRI Reporters (US EPA 2006).

This is the Accepted Version of a paper in Attwater, R. & Merson, J. (eds) (2007), "Sustaining our social and natural capital: Proceedings of the12th ANSYS Conference". 576 pp. ISBN: 978-0-9791688-8. ISCE Publishing, Mansfield, MA. Reference URLs updated, and minor changes made, in 2012.

2. Certification of performance under ISO's Standard 14001: Environmental Management Systems. In 1996, the International Standards Organization (ISO) released a standard set of procedures for any organization in any industry to follow in forming, implementing, evaluating, and communicating its environmental management system (EMS). OECD data indicates the size of the US social system meeting the 'any organization, any industry' eligibility criteria went from some 6.1M private establishments in 1995 to 7.1M in 2002. ISO 14001 procedures follow the Plan-Do-Check-Act steps in the management cycle of continuous improvement (ISO 2006). Should an organization decide to communicate its performance to external stakeholders, it seeks a certificate on its EMS from an accredited auditor. Global surveys on the number of ISO 14001 Certificates issued are conducted annually. Results illustrated in Figure 2 reflect US growth in ISO 14001certifications between 1995 and 2002, moving from 0.00003% to 0.01015% of saturation.

3.3 Comparing ISO 14001 Certifications among some OECD members

The current inventory of the ISO contains nearly 15, 000 standards, with its Standard 9000: Total Quality Management and Standard 14001: Environmental Management Systems being by far the most popular



(ISO 2004). The data sources used for Figure 2 again provide another example of a sustainability accounting tool's progression along the Innovation Adoption Curve.

This is the Accepted Version of a paper in Attwater, R. & Merson, J. (eds) (2007), "Sustaining our social and natural capital: Proceedings of the12th ANSYS Conference". 576 pp. ISBN: 978-0-9791688-8. ISCE Publishing, Mansfield, MA. Reference URLs updated, and minor changes made, in 2012.

Good sustainability policy built on an understanding of the Curve will use the instruments available to get adopters to the critical mass interval or tipping point within the shortest possible time, and with the least economic and political costs. Table 1 is built on a no-policy change scenario. It assumes average annual growth in ISO 14001 adopter numbers during 1998-2002 will continue into the future. The assumption is then used to estimate the time required to reach an ISO 14001 tipping point within each of the twenty-four countries in the OECD sample. Estimates reported in Table 1 show that even for developed countries the time taken from present to reach critical mass (or take-off point) may vary according to region between 480 to 5,500 years.

Table 1: Years to critical mass for ISO 14001 adoption: estimates for 24 OECD countries

Global Region	Countries in sample (n)	Establishments in Critical Mass Target (n)	Years to Critical Mass
Asia	2	471, 000	5, 500
Oceania	2	363, 000	3, 400
Americas	2	1, 200, 000	1, 800
Europe	18	2, 500, 000	480

Sources: ISO 2000; ISO 2004; OECD 2006

3.5 Comparing adoption in Australasia between community-of-practice and community-of-place

As with the US TRI Program and Bhopal, the Global Reporting Initiative (GRI) originated as a response to an environmental disaster: in this case the Exxon Valdez oil spill of 1989 (Consumer Protection Working Group 2002). The GRI is identified as the best seed on which to grow a uniform global framework for reporting any organization's performance in relation to sustainability (eg Ranganathan 1999; UN Division for Sustainable Development 2002). Evolution and adoption of GRI is driven by seeking consensus among stakeholders, and involves organizations located in sixty countries (GRI 2006). Where significant efforts are made to create a community-of-practice, the GRI is probably the most well known among many hundreds of sustainability accounting tools.

Where significant efforts are made to sustain a community-of-place, Local Agenda 21 Planning (LA21) is probably the most well known among many hundreds of sustainability accounting tools. Its origins can be traced back to preparing for the 1992 Earth Summit, since Section 28.28 of Agenda 21 requires local authorities undertake a consultative process with their populations and achieve a consensus on a 'local Agenda 21' for the community (UN Division for Sustainable Development 1993). LA21 therefore shares with GRI the process of consensus seeking among stakeholders, but their system boundaries are defined by different characteristics.

Supplemented with data on adopter numbers and on the number of local authorities, OECD statistics on private establishments across all industry sectors again provides a platform for comparing the adoption of two sustainability accounting tools. Table 2 shows results from this comparison. Adoption of GRI and LA21 increased some three or four fold over the five years of most recent data available. Differences between the two practices on time remaining before reaching critical mass on their respective

Innovation Adoption Curves remain substantial. If growth in LA21 adoption rates between 1996-2001 continued, then around 2004 all local authorities in Australia and New Zealand could be engaged in this form of sustainability accounting. In Oceania, reaching critical mass with GRI does not seem possible within any reasonable planning horizon, should growth achieved under its arrangements and institutional settings of 2002-2006 continue.

Differences between GRI and LA21 with respect to interpersonal communication channels could be one reason for differences in their progress along the Innovation Adoption Curve. Rogers (1995: 82) discusses the significant differences between interpersonal and mass-media channels, with many small-scale empirical studies showing the former to be more effective in achieving a positive adoption decision.

Table 2: Progress in GRI and LA21 adoption - Oceania *circa* 1996-2006

	GRI	LA21
Organizations at Saturation Level	**2.4M**	**920**
Organizations @ Critical Mass (15% Saturation)	**360, 000**	**138**
Adopters as % Saturation in 'most recent' year (1)	**0.0028%**	**23%**
Adopters as % Saturation in ('most recent' - 5)	**0.0010%**	**5%**
Years from 'most recent' to Critical Mass	**43, 000**	**-2**
(1) 'most recent' for GRI = 2006; for LA21 = 2001		

Sources: Gilbert 2003;GRI 2006; ICLEI 2002; OECD 2006;UNCSD 1997

Community Innovation Surveys conducted in Europe, however, provide the most robust evidence. For example, a significant majority (>70%) of some 201, 000 enterprises adopting innovations during 1998-2001 did so through interpersonal communication channels within their own industry and market (Eurostat 2004). Governments, universities and research institutions (i.e. predominately transmitting via mass media channels) were identified as important sources of information in innovation adoption by a minority (<10%) of respondents. The ratio between non-adopter and adopter establishments also provides some understanding of the interpersonal communication task facing promoters of sustainability accounting. In Oceania, for GRI this ratio is around 36,000:1, compared with a ratio of 4:1 for LA21.

3.5 Summarising results

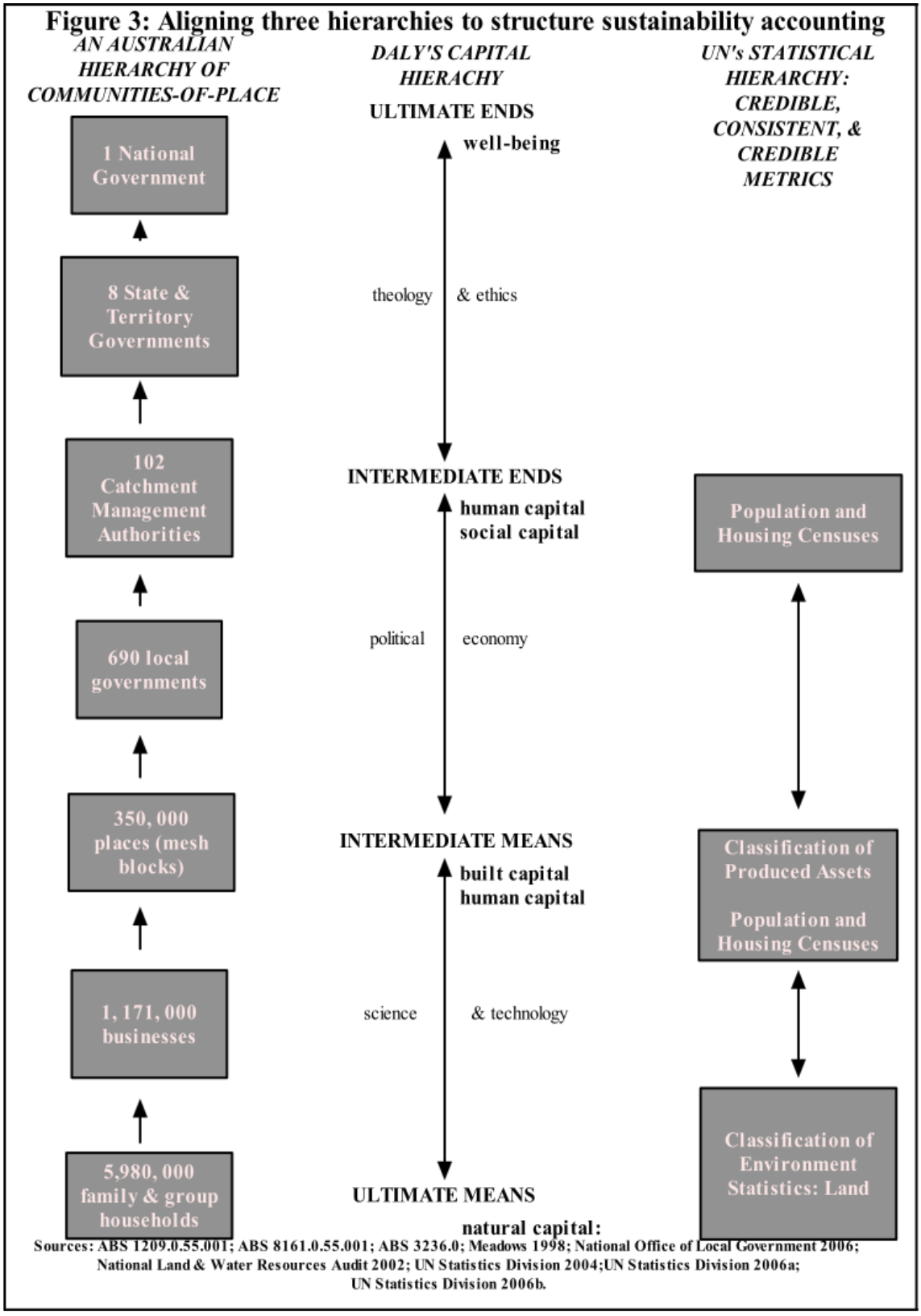
Some 40-70 years of using mass-media channels have failed to resolve disagreements between scientists and practitioners as to the why and what of sustainability accounting practice. The resulting mess transmits conflicting information, increasing the uncertainty that always accompanies the decision to adopt or reject an innovation (Rogers 1995: 6). Section 3 reflects this uncertainty by combining a generic Innovation Adoption Curve with secondary data on relatively well-known examples of sustainability accounting practices. LA21 in Oceania is the only case among examples considered where the critical mass benchmark is achieved. The activity thresholds of the US TRI Program limit disclosure requirements to one third of the critical mass benchmark within the social system it targets. The large social systems they target mean voluntary adoption of ISO 14001 and GRI is unlikely to reach critical mass within any reasonable planning horizon. Results support Peskin's (1998: 376) assertion that communication failure contributes to poor adoption of accounting for sustainability.

This is the Accepted Version of a paper in Attwater, R. & Merson, J. (eds) (2007), "Sustaining our social and natural capital: Proceedings of the12th ANSYS Conference". 576 pp. ISBN: 978-0-9791688-8. ISCE Publishing, Mansfield, MA. Reference URLs updated, and minor changes made, in 2012.

4. Resolving the mess's consequences

Giving shape and structure are necessary steps in dealing with a mess. Peskin's 1998 definition sees any

Figure 3: Aligning three hierarchies to structure sustainability accounting



Sources: ABS 1209.0.55.001; ABS 8161.0.55.001; ABS 3236.0; Meadows 1998; National Office of Local Government 2006; National Land & Water Resources Audit 2002; UN Statistics Division 2004;UN Statistics Division 2006a; UN Statistics Division 2006b.

form of accounting as a structured body of information describing change in a system's inputs and outputs relative to its state of balance. Anielski (2007) identifies the state of balance sought. In his Genuine Wealth model, sustainability is being achieved when the overall integrity of the five core capital assets of a community or organization (human, social, natural, built and financial capital) are non-declining in their overall physical and qualitative 'condition'. In this model, the conditions of the capital stocks and flows can be reported both in physical/qualitative terms (composite indices) and monetary (full cost) accounting terms (Anielski 2007).

Concepts and case studies on a capitals approach for tracking progress toward sustainable development are common at many levels of decision-making. Examples for businesses include Dyllick and Hockerts (2002) and the Sigma Project (British Standards Association,2003); for local communities include Kretzmann and McKnight (2005) and Roseland (2005); for engaging community stakeholders in qualitative assessments include Grosskurth and Rotmans (2005) and Osborn and Macfarlane (2006); and for national governments include UN Statistics Division (2005) and the World Bank (2006). Anielski's Genuine Wealth model provides therefore an overarching framework for accommodating many initiatives. What could a structured body of information look like when combining the Genuine Wealth model with multiple levels of sustainability governance? Accepting the evidence on adoption rates presented elsewhere pushes policy design toward promoting ideas and practices in sustainability accounting already well known by decision-makers, i.e. incremental not radical innovation.

Hierarchical structures are used frequently as mental models in learning for sustainability transition (Meadows 1998). Figure 3 aligns three existing hierarchies to create a structured body of information consistent with Anielski's Genuine Wealth model, and to realise the opportunities it provides for convergence between many initiatives. The hierarchy of capital stocks, where nature provides the means for achieving human well-being was proposed by Daly in 1973 (Meadows 1998:41), and is accepted by many as a guiding principle for structuring sustainability information. Each country has its own statistical geography where communities-of-place exist at different levels, and with their own sizes in terms of decision-making units.

An Australian example is provided here. The classification systems established as standards and guidelines by the UN's Statistical Commission provide hierarchical structures for codifying natural, built and human capital stocks with consistent, credible and comparable metrics. Data collection and dissemination will vary over time and space, but regularly engage many decision-makers through census and sample collections.

Applying secondary data to the shape of the Innovation Adoption Curve, together with seeing the structure possible from aligning three hierarchical models, provide opportunities for moving from mess to consensus on the why, what, and how of sustainability accounting.

This is the Accepted Version of a paper in Attwater, R. & Merson, J. (eds) (2007), "Sustaining our social and natural capital: Proceedings of the12th ANSYS Conference". 576 pp. ISBN: 978-0-9791688-8. ISCE Publishing, Mansfield, MA. Reference URLs updated, and minor changes made, in 2012.

5. References

Anielski M (2007), *Genuine Wealth Accounting (GWA): Measuring the Sustainability of Communities*. http://anielski.com/wp-content/documents/Genuine%20Wealth%20Communities.pdf.

Australian Bureau of Statistics (2008). Catalogue # 1209.0.55.002. Mesh Blocks Digital Boundaries, Australia. http://www.abs.gov.au/ausstats/abs@.nsf/mf/1209.0.55.002/.

Australian Bureau of Statistics, Catalogue # 3236.0. Household and Family Projections Australia 2001 to 2026. www.abs.gov.au.

Australian Bureau of Statistics, Catalogue # 8161.0.55.001. Business Register Counts of Businesses, Summary Table 2004. www.abs.gov.au.

Backstrand K (2003), Civic Science for Sustainability: Reframing the role of experts, policy-makers and citizens in environmental governance. *Global Environmental Politics* 3 (4): 24-41.

British Standards Assocation (2003),The SIGMA Guidelines: Putting sustainable development into practice: A Guide for Organisations. http://www.projectsigma.co.uk/Guidelines/SigmaGuidelines.pdf.

Cairns RD (2006), Accounting for the Environment or for Sustainable Development? Minerals Council of Australia.

Carver S (2001), Participation and Geographic Information: a position paper. ESF-NSF Workshop on Geographic Information and Participatory Approaches. www.centerforurbanstudies.com/.../public_participation_gis.pdf.

Consumer Protection Working Group (2002), The Desirability and Feasibility of ISO Corporate Social Responsibility Standards: Report from the Consumer Protection Working Group to the ISO Consumer Policy Committee (COPOLCO). www.iso.org/iso/livelinkgetfile?llNodeId=22124&llVolId=-2000.

Dyllick T and Hockerts K (2002), Beyond the business case for corporate sustainability. *Business Strategy and the Environment,* 11: 130-141.

Eurostat (2004), *Innovation in Europe: Results for the EU, Iceland and Norway*. 2004 Edition. ISBN 92-894-7262-6.

Gilbert S (2003), The GRI – An Institution and Emerging Standard. www.bcsd.org.tw/images/doc/701/20030818/01.PPT.

Gladwell M (2000), *The tipping point how little things can make a big difference*. Boston: Little Brown. ISBN 0-316-31696-2.

Global Reporting Initiative (2006), About GRI. www.globalreporting.org/about/.

Granovetter MS (1973), The Strength of Weak Ties, *American Journal of Sociology*, 78: 1360-1380.

Grosskurth J and Rotmans J (2005), Getting a grip on sustainable development in policy making, *Environment, Development and Sustainability*, 7 (1): 135-151.

Hales D and Prescott-Allen R (2002), Flying Blind: Assessing Progress Toward Sustainability, in Esty D and Ivanova MH (eds), *Global Environmental Governance: Options and Opportunities.*

International Council for Local Environmental Initiatives (2002), Second Local Agenda 21 Survey: Background Paper 15. www.iclei.org/documents/Global/final_document.pdf.

International Standards Organization (2001), *The ISO Survey of ISO 9000 and ISO 14000 Certificates: Tenth Cycle,* Geneva, ISO.

International Standards Organization (2004), The ISO Survey of ISO 9001:2000 and ISO 14001 Certificates – 2003. Geneva, ISO.

International Standards Organization (2006), ISO 9000/ISO 14000. www.iso.org/iso/en/iso9000-14000/ims/ims.html.

Institute of Chartered Accountants in England and Wales (2002), Quotation on p8, in Adams R, Accounting: Industry as a partner for sustainable development. London. Association of Certified Chartered Accountants and UN Environment Programme. ISBN: 92-807-21747-7.

Kretzmann JP and McKnight JL (2005), Discovering Community Power: A guide to mobilizing assets and your organization's capacity. The ABCD Institute.

Lambe P (2002) Accounting for Knowledge Management, Presentation to 16th World Congress of Accountants. www.greenchameleon.com/thoughtpieces/account.pdf.

Mackenzie A, Pidd M, Rooksby J, Sommerville I, Warren I, and Westcombe M (2006), Wisdom, decision support and paradigms of decision making, *European Journal of Operational Research* 170: 156-171.

Mathews MR (1997), Twenty-five years of social and environmental accounting research: Is there a silver jubilee to celebrate? *Accounting, Auditing and Accountability Journal*, 10, 4: 481-531.

Meadows D (1998), *Indicators and Information Systems for Sustainable Development: A Report to the Balaton Group*. Hartland Vermont. The Sustainability Institute.

National Office of Local Government (2006), Local Government National Report: 2004-05 Report on the operation of the Local Government (Financial Assistance) Act 1995. http://www.regional.gov.au/local/publications/reports/2004_2005/pdf/Local_report.pdf.

National Land and Water Resource Audit (2002), Australian Catchment, River and Estuary Assessment 2002. http://nrmonline.nrm.gov.au/catalog/mql:891.

Natural Resources Conservation Services (2001), Natural Resources Inventory: Background. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012175.pdf.

Nutley S, Davies H, and Walter I (2002), *Conceptual Synthesis 1: Learning from the Diffusion of Innovations. Working Paper Series: 10*, ESRC UK Centre for Evidence-Based Policy and Practice. http://www.kcl.ac.uk/content/1/c6/03/46/02/wp10.pdf.

OECD (1979), The State of the Environment in OECD Member Countries, Paris.OECD.

OECD (2006), Number of establishments and enterprises in OECD member countries. www.oecd.org/statsportal/.

Osborn D, Savage D, Reyes MF and Muradyan T (2002) Images of effectiveness, equity and efficiency in the diffusion of environmental management accounting. http://www2.accaglobal.com/pdfs/environment/newsletter/images.pdf.

Osborn D and Macfarlane M (2006), Sustaining communities by learning from integrated assessments of place, in Petheram RJ. and Johnson RC (eds.) *Practice change for sustainable communities: Exploring footprints, pathways and possibilities:* APEN 2006 International Conference, La Trobe University, Beechworth, Victoria, Australia, 6 – 8 March 2006. Published online at www.regional.org.au/au/apen/2006. The Regional Institute. ISBN 1 920842 31 4.

Pidd M (1996), *Tools for Thinking: Modelling in Management Science*, John Wiley and Sons, Chichester.

Peskin H (1998), Alternative resource and environmental accounting approaches and their contribution to policy, in Uno K and Bartelmus P (Eds) *Environmental Accounting in Theory and Practice*. Kluwer Academic Publishers Dordrecht/Boston/London ISBN 0-7923-4559-2.

President's Council for Sustainable Development (1999), *Towards a Sustainable America: Advancing Prosperity, Opportunity, and a Healthy Environment for the 21st Century.* http://clinton2.nara.gov/PCSD/Publications/tsa.pdf.

Ranganathan J (1999), Signs of Sustainability: Measuring Corporate Environmental and Social Performance, in Bennett M and James P (eds*), Sustainable Measures: Evaluation and Reporting of Environmental and Social Performance.* Greenleaf Publishing, Sheffield. ISBN 1874719160.

Richey T (2002), Modelling complex socio-technical systems using morphological analysis. www.swemorph.com/.

Rogers EM (1995), *Diffusion of Innovations, Fourth Edition*. New York. Free Press. ISBN 0-020926671-8.

Rogers EM, Medina UE, Rivera MA, and Wiley CJ (2005), Complex Adaptive Systems and the Diffusion of Innovations, *The Innovation Journal: The Public Sector Innovation Journal,* 10(3), article 30. www.innovation.cc/volumes-issues/rogers-adaptivesystem7final.pdf.

Roseland M (2005), *Toward Sustainable Communities. Third Edition*. Vancouver, Canada. New Society Publishers. ISBN: 0-86571-535-1.

Rural Reconstruction Commission (1944), Land utilization and farm settlement, The Commission's Third Report. Canberra. Australian Government Printer.

Siebenhuner B (2004), Social learning and sustainability science: which role can stakeholder participation play? *International Journal for Sustainable Development* 7(2): 146-163.

UN Commission for Sustainable Development (1997), A study of responses by local authorities and their national and international associations to Agenda 21: prepared by ICLEI and UNDPCSD. www.un.org/documents/ecosoc/cn17/1997/background/ecn171997-1.rept1.htm.

UN Division for Sustainable Development (1993), Agenda 21: Earth Summit – The United Nations Programme of Action from Rio. ISBN 9211005094.

UN Division for Sustainable Development (2002), Johannesburg:World Summit on Sustainable Development: Plan of Implementation. www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm.

UN Statistics Division (2003), Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003 (SEEA 2003). http://unstats.un.org/unsd/envaccounting/seea2003.pdf.

UN Statistics Division (2004), UN Statistics Division/UN Environment Programme Questionnaire 2004 on Environment Statistics: Land. http://unstats.org/unsd/environment/q2004land.pdf.

UN Statistics Division (2006a), Population and Housing Censuses. http://unstats.un.org/unsd/demographic/sources/census/census/censusmethods.htm.

UN Statistics Division (2006b), Classification of Produced Assets. http://unstats.un.org/unsd/Sna1993/tables/table_Annex_13.pdf.

US Environmental Protection Agency (2006), Toxic Release Inventory (TRI) Program. www.epa.gov/tri/.

Walker, B., S. Carpenter, J. Anderies, N. Abel, G. S. Cumming, M. Janssen, L. Lebel, J. Norberg, G. D. Peterson, and R. Pritchard. (2002). Resilience management in social-ecological systems: a working hypothesis for a participatory approach. *Conservation Ecology* 6(1): 14. www.consecol.org/vol6/iss1/art14/.

Walton JS, El-Haram M, Castillo NH, Horner RMW, Price ADF, and Hardcastle C (2005), Integrated assessment of urban sustainability, *Engineering sustainability* 158 (2): 57-65.

Water Science and Technology Board, Oceans Studies Board (2004), *Analytical Methods and Approaches for Water Resources Project Planning*, Washington DC. National Academies Press.

Wikipedia (2006), Accountancy. http://en.wikipedia.org/wiki/Accountancy.

World Bank (2005), *Where is the wealth of nations? Measuring capital in the 21st century*, Washington DC. http://siteresources.worldbank.org/INTEEI/214578-1110886258964/20748034/All.pdf.