Generally Accepted Integrated Accounting (GAIA) Principles

A Working Model Prepared by the
Center for Sustainable Organizations
May 9, 2023
(Update v2.6 – First published as GAAP-NF in November 2020)

CENTER FOR SUSTAINABLE ORGANIZATIONS

Contents

Executive Summary

- To be credible, measurement and reporting systems of any kind must be grounded in clearly articulated accounting principles appropriate to their scope
- None of the leading integrated and/or non-financial reporting standards or frameworks, however, are able to meet this requirement, since no such generally accepted principles for either form of accounting have been formally recognized or acknowledged by their makers
  - Leading standards for integrated and/or non-financial reporting are therefore premature and ad hoc, not to mention inconsistent with one another given the lack of a common foundation
- We therefore need formal recognition of the equivalent of GAAP or IFRS for integrated accounting!
  - A viable model for this is proposed herein: *Generally Accepted Integrated Accounting (GAIA) Principles*

Executive Summary (cont.)

- Our initial proposal (Nov. 2020) took the form of GAAP for non-financial accounting, or 'GAAP-NF'
  - In hindsight, we believe this was in error, since it would only encourage and extend the barrier between financial and non-financial accounting − sustainability accounting, too
- A better move, we now feel, would be to return to the original idea of integrated reporting, first put forward in the early King reports, but ultimately abandoned
  - The result of the abandonment has been the subordination of both integrated and non-financial accounting to financial accounting and shareholder primacy, thereby resulting in little more than *enhanced financial accounting (e.g., ESG)*
  - What we are now proposing, then, are principles for more robust and authentic integrated accounting that address not only non-financial performance, but financial performance too

Integrated Performance

- How credible are leading reporting standards for integrated and/or non-financial performance?
  - Global Reporting Initiative (GRI)
  - IFRS/ISSB (forthcoming as 'ISSB' in mid-2023)
  - CSRD/ESRS (forthcoming as 'ESRS' in mid-2023)
- One test of a standard's credibility is its consistency with underlying generally accepted accounting principles (e.g., financial reporting and GAAP or IFRS)
  - Question: What, then, are/were the pre-existing generally accepted accounting principles upon which today's leading *integrated and/or non-financial* reporting standards were based at the time of their creation?
  - Answer: No such principles were recognized, then or now. Existing and forthcoming standards (ESG, too), therefore, were and are ad hoc/premature and largely fail to deliver!

Integrated Performance (cont.)

- For example, GRI, ISSB and ESRS all fail to assess or report sustainability performance in authentic terms
  - How could they? They make no attempt to acknowledge, much less build on, generally accepted accounting principles for sustainability or integrated accounting as a first step
  - Thus, even the three leading standards themselves have taken inconsistent approaches to the subject, thereby begging the question of what the underlying principles are or should be
- And if their intellectual grounding in such accounting is so dubious, how can they possibly be trusted as indicators of organizational performance?
  - Answer: They can't! Even ostensibly positive performance per the leading standards can be driven by activities & impacts that are unsustainable and which put stakeholder well-being at risk

We Need Integrated Accounting Principles!

- In order to obtain meaningful measures of integrated performance, we need the functional equivalent of GAAP or IFRS for financial accounting, but for integrated accounting instead
- In other words, we need *Generally Accepted Integrated Accounting (GAIA) Principles!*
  - GAIA Principles would provide a rigorous basis for integrated performance measurement and reporting (to which GRI, ISSB, ESRS and others could conform)
  - This would make meaningful integrated accounting and reporting possible (i.e., for both financial and non-financial performance), including sustainability
  - GAIA Principles, in fact, already exist!

We Need Integrated Accounting Principles (cont.)

- Context-based accounting* principles are already used for financial reporting and are also now explicitly called for in GRI, ESRS and the UN
  - GRI: the Sustainability Context Principle
  - ESRS: thresholds & allocations in environmental metrics
  - UN: Sustainable Development Performance Indicators**
- Context-based principles have long been applied to financial accounting (i.e., fiduciary duties owed to shareholders for impacts on equity capital)
- The stage is now clearly set to operationalize integrated accounting using context-based principles

*https://en.wikipedia.org/wiki/Context-Based_Sustainability
**https://cdn.unrisd.org/assets/library/reports/2022/manual-sdpi-2022.pdf

Reference Model for Generally Accepted Integrated Accounting (GAIA) Principles

Reference Model for Generally Accepted Integrated Accounting (GAIA) Principles

		Generally Accepted Accounting Principles (e.g., GAAP and IFRS)	Generally Accepted Integrated Accounting (GAIA) Principles
Regulative Ideals (Intrinsically Valued Goal States)		**Shareholder Well-Being**	**Stakeholder Well-Being**
Core Underlying Theories of Performance		Shareholder/Economic Value *(aka, Value Creation)* [1]	*Sustainability* [2]
INDICATORS	**Resources (capital stocks and flows)**	*Equity = Assets - Liabilities* (balance sheets apply here)	Multi-Capital Sufficiency (multi-capital accounting applies here; and possibly non-financial analogues or enhancements to financial reports)
	Transactions (impacts on stocks and flows)	*Profitability Performance = Revenue - Costs* (impacts measured in units of money; double-entry bookkeeping and income statements apply here)	*Sustainability Performance = Actual Impacts / Normative Impacts* (S=A/N); impacts measured in units of carrying capacities of capitals; context-based metrics and TBL scorecards apply here [3]

Some Historical Principles in GAAP and IFRS [4] and Whether They are Extensible to GAIA Principles (Yes/No)	
1. Accounting entity	Yes
2. Algebraic opposition (dual aspect concept)	No, there is no zero sum enforced here
3. Single monetary unit	No; uses non-monetary units of measurement instead (i.e., of the *carrying capacities* of capitals as indicated below)
4. Proprietors' equity	No, stakeholder entitlements more broadly construed are prioritized instead (see below)
5. Profit or loss	No
6. Accounting period	Yes
7. Materiality	Yes, but broader in scope (see below)

Additional Foundational Principles Applicable to GAIA (for a total of twelve)	
1. Stakeholders	Individuals or groups to whom duties & obligations are owed to manage one's impacts on vital capitals in ways that can affect their well-being. [3]
2. Duties and Obligations	Morally binding responsibilities to have, not have, or otherwise manage one's impacts on vital capitals in ways that recognize and respect the rights of others. [3]
3. Vital Capitals	Stocks and flows of resources that people rely on for their well-being (i.e., human, social, constructed, economic, intellectual, and natural capitals that yield valuable goods and services). [3, 5]
4. Carrying Capacity	The extent of demand for its goods or services a capital can fulfill without degrading or exceeding the limitations of its stocks and/or flows.
5. Thresholds	Upper and lower limits in the carrying capacities of capitals that must be maintained in order to ensure human well-being. [3, 6]
6. Allocations	Entity-specific fair, just, and proportionate shares of duties or obligations owed to maintain the carrying capacities of vital capitals at levels required to ensure stakeholder well-being, either by preserving or producing them. [3, 6]
7. Materiality	The degree to which actual or possible impacts on vital capitals correspond to any duties or obligations owed to stakeholders. [3, 7]
8. Sustainability	The degree to which human impacts on vital capitals have the effect of maintaining them at levels required to ensure stakeholder well-being (i.e., in accordance with duties and obligations owed to preserve and/or produce them, as the case may be). [3]
9. Substitutability	The extent to which the diminishment or loss of one type of capital can or cannot be compensated for by the excess availability or production of another (e.g., the view that capitals of different kinds are generally not interchangeable with one another and must therefore be separately maintained at required levels). [8]
10. Commensurability	The degree to which measures of impacts on disparate capitals are expressed in terms of a common conceptual framework and on a common scale, such as sustainability performance, so that measurements can be combined in like terms.

[1] Calls for maximizing shareholder value with particular emphasis, therefore, on impact valuation and risk management. All impacts are monetized and then integrated in monetary terms.

[2] Calls for prioritizing all stakeholders' well-being in the sense that all impacts must be assessed relative to sustainability norms or standards for what they would have to be in order to maintain capital resources at levels required to ensure stakeholder well-being. Can also be interpreted as a surrogate for *responsibility performance (i.e., sustainability performance* is just a proxy).

[3] McElroy, M. (2008) *Social Footprints – Measuring the Social Sustainability Performance of Organizations*, University of Groningen, dissertation; see also McElroy, M. and Van Engelen, J. (2012) *Corporate Sustainability Management – The Art and Science of Managing Non-Financial Performance*, Earthscan; Thomas, M. and McElroy, M. (2016) *The MultiCapital Scorecard – Rethinking Organizational Performance*, Chelsea Green Publishing; and McElroy, M. (2022) "Rights, Duties and Corporate Social 'Kantracts'": https://www.sustainableorganizations.org/Rights-Duties-Corporate-Social-Kantracts.pdf.

[4] The specific GAAP principles shown here are admittedly incomplete and are limited to only those which are historically foundational and which therefore call for immediate attention as to whether or not they are applicable or extensible to GAIA principles in some way; based in large part on Lee, G. (1977) "Coming of age of double entry: The Giovanni Farolfi ledger of 1299-1300", *Accounting Historians Journal*: Volume 4: Issue 2, Article 6, and Lee, G. (1986) *Modern Financial Accounting*, 4th Edition, Van Nostrand, Berkshire.

[5] See also Gleeson-White, J. (2014) *Six Capitals, or Can Accountants Save the Planet?* W.W. Norton, New York; and "Some Important Works in the Literature on the Capital Theory Basis of Sustainability": https://www.sustainableorganizations.org/Capital-Theory-References.pdf

[6] See also McElroy, M. (2022) "Thresholds, Allocations and the Carrying Capacities of Capitals": https://www.sustainableorganizations.org/Thresholds-Allocations-CarryingCapacities.pdf, and "An Intellectual History of Thresholds and Allocations" (2018), Center for Sustainable Organizations: https://www.sustainableorganizations.org/TA-Timeline.pdf

[7] McElroy, M. (2019) "Making Materiality Determinations – A Context-Based Approach", UNRISD: https://www.unrisd.org/mcelroy

[8] See, for example, Dresner's treatment of 'strong' versus 'weak' sustainability (Dresner (2002) *The Principles of Sustainability*, Earthscan, London.

Generally Accepted Integrated Accounting (GAIA) Principles

Generally Accepted Integrated Accounting (GAIA) Principles[1]	
1. Accounting Entity	The concept of a business or accounting entity whose books record its performance, as distinct from its owners or shareholders.
2. Accounting Period	A defined period of time for which performance is measured.
3. Stakeholders	Individuals or groups to whom duties & obligations are owed to manage one's impacts on vital capitals in ways that can affect their well-being.
4. Duties & Obligations	Morally binding responsibilities to have, not have, or otherwise manage one's impacts on vital capitals in ways that recognize and respect the rights of others.
5. Vital Capitals	Stocks and flows of resources that people rely on for their well-being (i.e., human, social, constructed, economic, intellectual, and natural capitals that yield valuable goods and services).
6. Carrying Capacity	The extent of demand for its goods or services a capital can fulfill without degrading or exceeding the limitations of its stocks and flows.
7. Thresholds	Upper and lower limits in the carrying capacities of capitals that must be maintained in order to ensure human well-being.
8. Allocations	Entity-specific fair, just, and proportionate shares of duties and obligations owed to maintain the carrying capacities of vital capitals at levels required to ensure stakeholder well-being, either by preserving or producing them.
9. Materiality	The degree to which actual or possible impacts on vital capitals correspond to any duties or obligations owed to stakeholders.
10. Sustainability	The degree to which human impacts on vital capitals have the effect of maintaining them at levels required to ensure stakeholder well-being (i.e., in accordance with duties and obligations owed to preserve and/or produce them, as the case may be).
11. Substitutability	The extent to which the diminishment or loss of one type of capital can or cannot be compensated for by the excess availability or production of another (e.g., the view that capitals of different kinds are generally not interchangeable with one another and must therefore be separately maintained at required levels).
12. Commensurability	The degree to which measures of impacts on disparate capitals are expressed in terms of a common conceptual framework and on a common scale, such as sustainability performance, so that measurements can be combined in like terms.

[1]As proposed by Mark W. McElroy, PhD, and in accordance with *Context-Based Sustainability* theory and practice: https://en.wikipedia.org/wiki/Context-Based_Sustainability

Intellectual History and Basis of GAIA Principles*

(See next slide for more complete citations)

Generally Accepted Integrated Accounting (GAIA) Principles[1]	
1. Accounting Entity	The concept of a business or accounting entity whose books record its performance, as distinct from its owners or shareholders.
2. Accounting Period	A defined period of time for which performance is measured.
3. Stakeholders	Individuals or groups to whom duties & obligations are owed to manage one's impacts on vital capitals in ways that can affect their well-being.
4. Duties & Obligations	Morally binding responsibilities to have, not have, or otherwise manage one's impacts on vital capitals in ways that recognize and respect the rights of others.
5. Vital Capitals	Stocks and flows of resources that people rely on for their well-being (i.e., human, social, constructed, economic, intellectual, and natural capitals that yield valuable goods and services).
6. Carrying Capacity	The extent of demand for its goods or services a capital can fulfill without degrading or exceeding the limitations of its stocks and flows.
7. Thresholds	Upper and lower limits in the carrying capacities of capitals that must be maintained in order to ensure human well-being.
8. Allocations	Entity-specific fair, just, and proportionate shares of duties and obligations owed to maintain the carrying capacities of vital capitals at levels required to ensure stakeholder well-being, either by preserving or producing them.
9. Materiality	The degree to which actual or possible impacts on vital capitals correspond to any duties or obligations owed to stakeholders.
10. Sustainability	The degree to which human impacts on vital capitals have the effect of maintaining them at levels required to ensure stakeholder well-being (i.e., in accordance with duties and obligations owed to preserve and/or produce them, as the case may be).
11. Substitutability	The extent to which the diminishment or loss of one type of capital can or cannot be compensated for by the excess availability or production of another (e.g., the view that capitals of different kinds are generally not interchangeable with one another and must therefore be separately maintained at required levels).
12. Commensurability	The degree to which measures of impacts on disparate capitals are expressed in terms of a common conceptual framework and on a common scale, such as sustainability performance, so that measurements can be combined in like terms.

[1]As proposed by Mark W. McElroy, PhD, and in accordance with *Context-Based Sustainability* theory and practice: https://en.wikipedia.org/wiki/Context-Based_Sustainability

Pacioli, 1494
Moonitz, 1961
Grady, 1965

Freeman, 1984

Fisher, 1906
Boulding, 1949
Ekins, 1992
Elkington, 1997
Porritt, 2005
Stiglitz et al, 2009
IIRC, 2013
Gleeson-White, 2014

Ward et al, 1974
Wackernagel, 1994
GRI, 2002
McElroy, 2008
Rockstrom et al, 2009
Raworth, 2012

Dohr, 1950
Moonitz, 1961
Bernstein, 1967
Eccles and Krzus, 2015
McElroy, 2019

Pearce et al, 1987
Daly, 1996
Dresner, 2002

Pacioli, 1494
Moonitz, 1961
Grady, 1965

Kant, 1785
Rawls, 1971
Shue, 1980
Evan and Freeman, 1988
Bowie, 1998

Costanza et al, 1992
Wackernagel and Rees, 1996
Meadows, 1998
McElroy, 2008

Wackernagel and Rees, 1996
McElroy, 2008
Randers, 2012
SBTN, 2020

Meadows et al, 1972
Daly, 1977
WCED, 1987
Pearce et al, 1987
Wackernagel, 1994
McElroy, 2008

Popper, 1970
Kuhn, 1970
Firestone, 1975

***Emblematic only, not intended to be complete**

Detailed References for Intellectual History Citations Provided for GAIA Principles

Bernstein. L. 1967. "The Concept of Materiality." *The Accounting Review* 42:1 86-95.

Boulding. K. 1949. "Income or Welfare." *The Review of Economic Studies* 17:2 77-86.

Bowie, N. 1998. "A Kantian Theory of Capitalism." *Business Ethics Quarterly – The Ruffin Series* #1 37-60.

Costanza et al. 1997. *An Introduction to Ecological Economics*. Boca Raton: CRC Press.

Daly, H. 1977. *Steady-State Economics*. San Francisco: Freeman.

Dohr, J. 1950. "Materiality - What Does it Mean in Accounting?" *Journal of Accountancy* 122:1 54-56.

Dresner, S. 2002. *Principles of Sustainability*. London: Earthscan.

Eccles, R. and Krzus, M. 2015. *The Integrated Reporting Movement*. Hoboken: Wiley.

Ekins, P. 1992. "A Four-Capital Model of Wealth Creation." In P. Ekins and M. Max-Neef (eds.) *Real Life Economics*. London: Routledge.

Elkington, J. 1997. *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. Oxford: Capstone Publishing Limited.

Evan, W. and Freeman, R.E. 1988. "A Stakeholder Theory of the Modern Corporation: Kantian Capitalism." In T. Beauchamp and N. Bowie (eds.) *Ethical Theory and Business*. Englewood Cliffs: Prentice-Hall.

Firestone, J. 1975. A New Paradigm for Philosophy of Science. Unpublished.

Fisher, I. 1906. *The Nature of Capital and Income*. London: Macmillan.

Freeman, R.E. 1984. *Strategic Management: A Stakeholder Approach*. Boston: Pitman.

Gleeson-White, J. 2015. Six Capitals, Or Can Accountants Save the Planet? New York: W.W. Norton.

Grady, P. 1965. *Inventory of Generally Accepted Accounting Principles. Accounting Research Study No. 7*. New York: AICPA

GRI (Global Reporting Initiative). 2002. *Sustainability Reporting Guidelines*. Boston: GRI.

IIRC (International Integrated Reporting Council). 2013. *International Integrated Reporting <IR> Framework*. IIRC.

Kant, I. 1785. *Groundwork for the Metaphysics of Morals.* Riga: Johann Friedrich Hartknoch.

Kuhn, T. 1970. "Reflections on My Critics." In I. Lakatos and A. Musgrave (eds.) *Criticism and the Growth of Knowledge*. Cambridge: Cambridge University Press.

Meadows, D.H. et al. 1972. *The Limits to Growth*. New York: Universe Books.

McElroy, M. 2008. Social Footprints. PhD. diss., University of Groningen. Accessible online at: https://research.rug.nl/en/publications/social-footprints-measuring-the-social-sustainability-performance

McElroy, M. 2019. Making Materiality Determinations: A Context-Based Approach. United Nations Research Institute for Social Development (UNRISD). Accessible online at: https://www.unrisd.org/mcelroy

Moonitz, M. 1961. The Basic Postulates of Accounting. New York: AICPA

Pacioli, L. 1494. *Summa de Arithmetica, Geometria, Proportione et Proportionalita*. Venice: Paganino de Paganini.

Pearce et al. 1989. *Blueprint for a Green Economy*. London: Earthscan.

Popper, K. 1970. "Normal Science and Its Dangers." In I. Lakatos and A. Musgrave (eds.) *Criticism and the Growth of Knowledge*. Cambridge: Cambridge University Press.

Porritt, J. 2005. *Capitalism as if the World Matters*. London: Earthscan.

Randers, J. 2012. "Greenhouse Gas Emissions Per Unit of Value Added ('GEVA') – A Corporate Guide to Voluntary Climate Action." *Energy Policy* 48: 46-55.

Rawls, J. 1971. *Theory of Justice*. Cambridge: Harvard Univ. Press.

Raworth, K. 2012. *A Safe and Just Space for Humanity: Can We Live Within the Doughnut?* Oxfam discussion paper. Oxford: Oxfam International.

Rockstrom, J. et al. 2009. "A Safe Operating Space for Humanity." *Nature*. 461: 472-5.

SBTN (Science Based Targets Network). 2020. *Science-Based Targets for Nature: Initial Guidance for Business*. Accessible online at: https://sciencebasedtargetsnetwork.org/wp-content/uploads/2020/11/Science-Based-Targets-for-Nature-Initial-Guidance-for-Business.pdf

Shue, H. 1980. *Basic Rights*. Princeton: Princeton University Press.

Stiglitz et al. 2009. *Report by the Commission on the Measurement of Economic Performance and Social Progress.* Accessible online at: https://ec.europa.eu/eurostat/documents/8131721/8131772/Stiglitz-Sen-Fitoussi-Commission-report.pdf

Wackernagel, M. 1994. Ecological Footprint and Appropriated Carry Capacity: A Tool for Planning Toward Sustainability. PhD diss., University of British Columbia. Accessible online at: https://open.library.ubc.ca/soa/cIRcle/collections/ubctheses/831/items/1.0088048

Wackernagel, M. and William Rees. 1996. *Our Ecological Footprint – Reducing Human Impact on the Earth*. Gabriola Island: New Society Publishers.

WCED (World Commission on Environmental and Development). 1987. *Our Common Future*. Oxford: Oxford University Press.

How the *Value Creation* Doctrine (e.g., GAAP and IFRS) Compares to the GAIA Principles

Extent to Which GAAP/IFRS Conforms to GAIA Principles[1]	
1. Accounting Entity	Yes – fully conforms
2. Accounting Period	Yes – fully conforms
3. Stakeholders	No – is concerned only with the well-being of shareholders, very often by law
4. Duties & Obligations	Yes – but only with respect to shareholders and fiduciary duties owed to them
5. Vital Capitals	Yes – but only with respect to shareholder value (economic capital)
6. Carrying Capacity	No – not per se, but does seek to maximize value of economic capital
7. Thresholds	Yes – variously, including with respect to minimum return on capital goals
8. Allocations	Yes – organizations are solely responsible for growing economic capital
9. Materiality	Yes – but only with respect to investor-related needs (i.e., their decisions)
10. Sustainability	No – externalizing costs in ways that degrade vital capitals is acceptable
11. Substitutability	No – GAAP/IFRS is concerned with only one type of capital, economic
12. Commensurability	No – GAAP/IFRS rely exclusively on monetization for all transactions

[1]As proposed by Mark W. McElroy, PhD, and in accordance with *Context-Based Sustainability* theory and practice: https://en.wikipedia.org/wiki/Context-Based_Sustainability

Summary and Conclusions

- **Mainstream integrated, non-financial, and sustainability accounting standards are largely predicated on the *Value Creation* doctrine or theory of performance endemic to shareholder primacy**
  - **Leading standards, in particular, either disregard or merely gloss over longstanding sustainability principles in the field and focus instead on reporting only**
  - **The result is a form of measurement and reporting that is ad hoc, premature, and fails to disclose either sustainability or integrated performance in authentic terms**
- **The need for *GAIA Principles* is therefore urgent!**

Thank you!

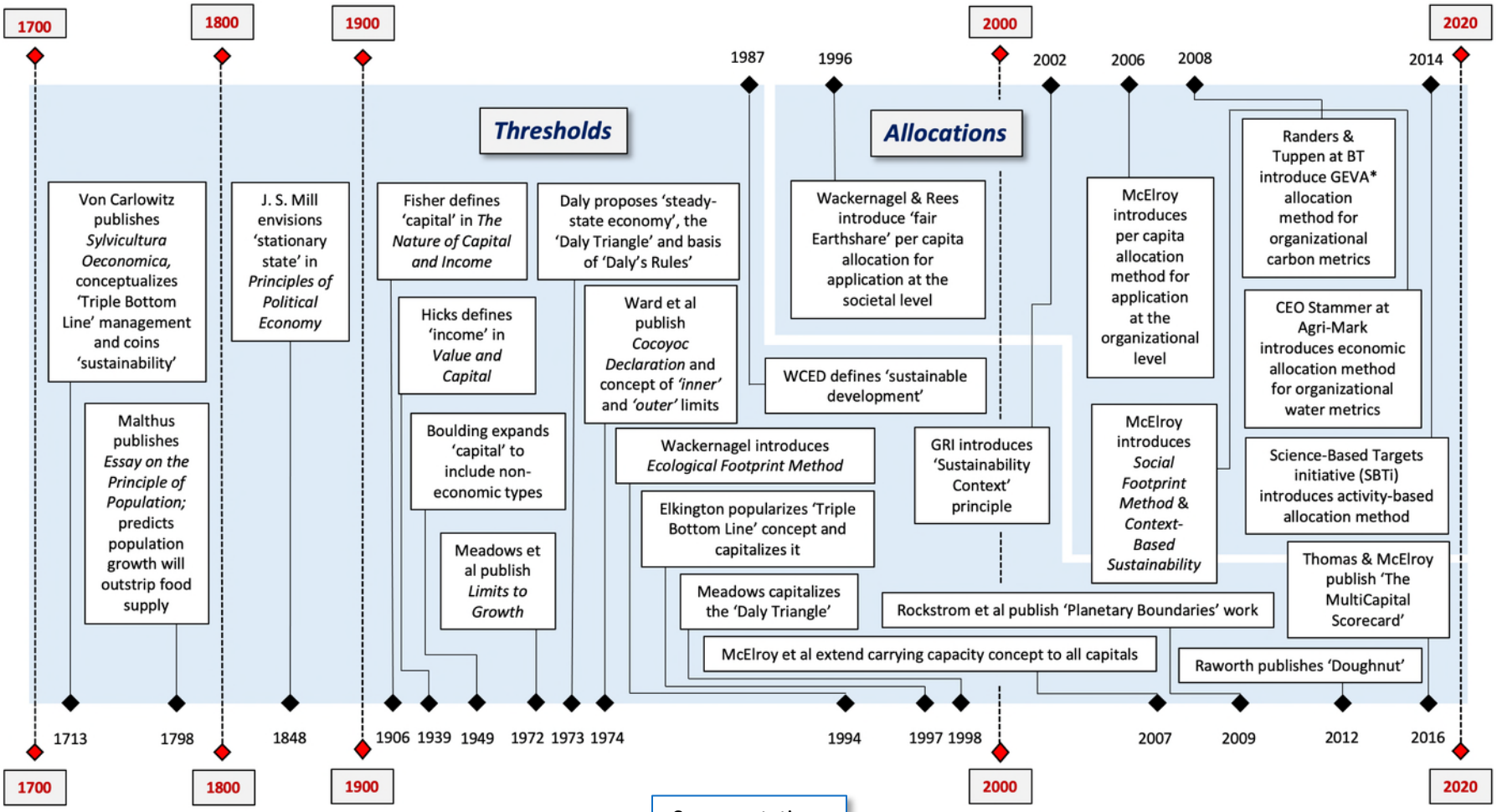
Comments and suggestions most welcome

Contact Mark W. McElroy, PhD
mmcelroy@vermontel.net

Appendix – Intellectual History of Thresholds and Allocations

An Intellectual History of Thresholds & Allocations

(and their underlying foundations in capital theory)



*GEVA = Greenhouse Gas Emissions per Unit of Economic Value Added

See annotations on next slide

Annotations to the Thresholds & Allocations Timeline

1. **Von Carlowitz (1713)**: Introduced thresholds-based sustainability management and also, arguably, triple bottom line thinking; coined 'sustainability' in his book; all at a meso level of analysis (forestry).
2. **Malthus (1798)**: First to apply thresholds thinking at the macro human scale and to put risks to human survival in light of it on the table.
3. **J. S. Mill (1848)**: First to put forward a 'stationary-state' economic model grounded in thresholds.
4. **Fisher (1906)**: An economist who was first to put forward a theory and definition of 'capital' grounded in thresholds and which has shaped the contours of sustainability thinking ever since (i.e., that capitals are stocks of valuable resources/wealth that produce flows of 'income').
5. **Hicks (1939)**: Another economist who built on Fisher's contributions by further elaborating on the nature of capital flows (income) and the extent to which they can be consumed without putting the underlying stocks at risk.
6. **Boulding (1949)**: Again, an economist, whose writings constitute the earliest evidence of 'capital', the construct, being expanded to include multiple, non-economic forms.
7. **Meadows et al (1972)**: The first, multi-dimensional, global application of thresholds-based thinking (i.e., not limited to food supplies as Malthus was) to the study of human survival on Earth, all with the aid of system dynamics.
8. **Daly (1973)**: Built on Mill's notion of a 'stationary-state' economy by expressing it in terms of impacts on natural resources relative to thresholds; referred to it as a 'steady state' model. Included a model for understanding the relationships between ultimate means, intermediate means, and human well-being ('Daly's Triangle), and also the basis for what later became known as 'Daly's Rules'.
9. **Ward et al (1974)**: Introduced the combination of upper (ecological) and lower (socioeconomic) limits in resources/conditions on Earth – referred to by them as 'outer' and 'inner' limits, respectively.
10. **WCED (1987)**: WCED publishes the Brundtland Commission report, *Our Common Future*, in which sustainable development is defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."
11. **Wackernagel (1994)**: Introduced the Ecological Footprint Method, the first measurement and reporting system for assessing the sustainability of human impacts on natural capitals vis a vis their thresholds; used a blended measure of 'bioproductive capacity' to quantify the carrying capacities (thresholds) of natural capital on Earth.
12. **Wackernagel and Rees (1996)**: Introduced the first normative principle (and metric) for determining what humanity's impacts on natural capital *ought* to be (i.e., that it should be calibrated in per capita terms). Referred to it as 'Fair Earthshares'; was applied only to macro, societal levels.
13. **Elkington (1997)**: Proposed the idea that the performance of organizations should be assessed in terms of their 'triple bottom line' performance and, importantly, that such assessments should be thought of in terms of their impacts on multiple vital capitals.

Cont.

Annotations to the Thresholds & Allocations Timeline (cont.)

14. **Meadows (1998)**: Puts forward a capitalized interpretation of 'Daly's Triangle', whereby all 'Ultimate Means' are represented as natural capitals, and all other resources important for human well-being are represented as capitals of other kinds.
15. **GRI (2002)**: Introduced Sustainability Context principle in the 'G2' edition of its *Guidelines*.
16. **McElroy (2006 [see McElroy 2008 146-9; 183-208])**: Introduced the per capita allocation method at the organizational level of analysis, thereby constituting world's first systematic approach for making fair, just and proportionate allocations of sustainability norms and thresholds at the organizational level.
17. **McElroy et al (2007)**: Introduced extended application of the carrying capacity concept to all capitals, not just natural capital, as part of the R&D leading up to McElroy's dissertation in 2008.
18. **McElroy (2008)**: Introduced the Social Footprint Method and Context-Based Sustainability at the organizational (micro) level of analysis; would later go on to apply both at the meso and macro levels.
19. **Randers and Tuppen (2008)**: Developed and applied first GEVA (Greenhouse Gas Emissions per Unit of Economic Value Added) allocation method used in conjunction with a context-based carbon metric (at BT).
20. **Stammer (2008)**: Developed and applied first economic allocation method used in conjunction with a context-based water metric (at Agri-Mark/Cabot).
21. **Rockstrom et al (2009)**: Introduced 'Planetary Boundaries' model that measures and reports the sustainability of humanity's impacts on vital ecological resources in the world; provides a new, component-based alternative to the Ecological Footprint Method.
22. **Raworth (2012)**: Builds on Ward et al's work, in particular, to more fully elaborate the 'inner' and 'outer' limits concept put forward in 1974; provides a reference model in visual form that can inform practice.
23. **SBTi (2014)**: First multi-NGO embrace of thresholds-, allocations-, science- and context-based metrics for application at the organizational (micro) level; also introduced an activity-based allocation method as part of their Sectoral Decarbonization Approach (SDA) target-setting tool; signaled start of growing adoption of context-based measurement, management and reporting worldwide; would later inspire similar efforts, such as the Science-Based Targets Network initiative now underway.
24. **Thomas & McElroy (2016)**: Introduced world's first fully integrated and context-based Triple Bottom Line method (the MultiCapital Scorecard, or MCS), in such a way as to combine the application of thresholds and allocations principles in a single performance accounting tool. The MCS, an open-source method, has since been used at the organizational, municipal and national levels to assess the sustainability performance of human social systems and is arguably the most advanced implementation of Context-Based Sustainability. Note: This book followed an article published in 2015 by the same title, and also the introduction of the authors' underlying concept of 'Multicapitalism' in 2014: http://www.multicapitalism.com/Multicapitalism.pdf

See references on next slide

Key References in the Thresholds and Allocations Literature
(in chronological order by category)

Important Pre-Twentieth Century Works on Thresholds

- Von Carlowitz, H. (1713) *Sylvicultura Oeconomica*. Leipzig: Johann Friedrich Brauns.
- Malthus, T. (1798) *An Essay on the Principle of Population As It Affects the Future Improvement of Society, with Remarks on the Speculations of Mr. Goodwin, M. Condorcet and Other Writers*. London: J. Johnson.
- Mill, J. (1848) *Principles of Political Economy, with Some of Their Applications to Social Philosophy*. London: John W. Parker.

Important Twentieth Century Works on Thresholds

- Fisher, I. (1906) *The Nature of Capital and Income*. New York: The Macmillan Company.
- Hicks, J. (1939) *Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory*. Oxford: Clarendon Press.
- Boulding, K. (1949) 'Income or welfare', *The Review of Economic Studies*, 17, 2, pp. 77-86.
- Meadows, D. et al (1972) *The Limits to Growth*. New York: Universe Books.
- Daly, H. (1973) *Toward a Steady-State Economy*. San Francisco: Freeman.
- Ward, B. et al (1974) *The Cocoyoc Declaration*. Cocoyoc: UNEP/United Nations Conference on Trade and Development (UNCTAD) Symposium on Patterns of Resource Use, Environment and Development Strategies.
- Wackernagel, M. (1994) *Ecological Footprint and Appropriated Carrying Capacity: A Tool for Planning Toward Sustainability* [doctoral dissertation]. British Columbia: University of British Columbia.
- Elkington, J. (1997) *Cannibals With Forks*. Oxford: Capstone Publishing Limited.
- Meadows, D.H. (1998) *Indicators and Information Systems for Sustainable Development*. Hartland: Sustainability Institute.
- McElroy et al (2007) 'Sustainability quotients and the social footprint', *Corporate Social Responsibility and Environmental Management*, 15, 4, pp. 223-34.
- Rockstrom et al (2009) 'A safe operating space for humanity', *Nature*, 461, pp. 472-475.
- Raworth, K. (2012) A safe and just space for humanity: can we live within the doughnut?', *Oxfam Discussion Papers*, Oxford: Oxfam International.

Important Twentieth & Twenty-First Century Works on Allocations (and the integrated accounting methods that came with them)

- Wackernagel, M. and Rees, W. (1996) *Our Ecological Footprint – Reducing Human Impact on Earth*. Gabriola Island: New Society Publishers.
- McElroy, M. (2008) *Social Footprints – Measuring the Social Sustainability Performance of Organizations* [doctoral dissertation]. Groningen: University of Groningen.
- McElroy, M. and van Engelen, J. (2012) *Corporate Sustainability Management – The Art and Science of Managing Non-Financial Performance*. London: Earthscan/Routledge/Taylor & Francis; pp. 128-129 and 214-219 [an account of how Agri-Mark CEO, R. Stammer, formulated an economic allocation for his company's 2008 study of their 2007 water use at one of their manufacturing facilities].
- Randers, J. (2012) "Greenhouse Gas Emissions Per Unit of Value Added ('GEVA') – A Corporate Guide to Voluntary Climate Action." *Energy Policy* 48: 46-55.
- Thomas, M. and McElroy, M. (2016) *The MultiCapital Scorecard*. White River Junction: Chelsea Green.