Thresholds, Allocations and the Carrying Capacities of Capitals:

Core Principles in Sustainability and Integrated Accounting

By Mark W. McElroy, PhD[1]
Founding Director, Center For Sustainable Organizations

History will very likely show that it wasn't until 2009 that the capital-based theory of sustainability finally took hold. Indeed it was in that year that economists Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi published their groundbreaking *Report by the Commission on the Measurement of Economic Performance and Social Progress* in which they wrote (2009, 11):

> "Current well-being has to do with both economic resources, such as income, and with non-economic aspects of people's lives (what they do and what they can do, how they feel, and the natural environment they live in). Whether these levels of well-being can be sustained over time depends on whether stocks of capital that matter for our lives (natural, physical, human, social) are passed on to future generations."

They went on to add (2009, 265):

> "… on a complicate[d] subject where many misunderstandings can take place, it is good practice to first start by elaborating a common language or a common general framework. The one that we have tried to emphasize is the so-called 'stock-based' or 'capital-based' or 'wealth-based' approaches to sustainability. The argument is that, ultimately, the sustainability issue is about how much stocks of resources we leave to future periods or future generations, and the question is whether we leave enough of these to maintain opportunity sets at least as large as the one we have inherited …"

Exactly sixty years earlier, it was another economist, Kenneth Boulding, who arguably launched the capital-based theory of sustainability in a 1949 article of his entitled, "Income or Welfare". Therein he wrote (1949, 79-80):

> "I shall argue that it is the capital stock from which we derive satisfactions, not from the additions to it (production) or the subtractions from it (consumption): that consumption, far from being a desideratum, is a deplorable property of the capital stock which necessitates the equally deplorable activities of production: and that the objective of economic policy should not be to maximize consumption or production, but rather to minimise it, i.e. to enable us to maintain our capital stock with as little consumption or production as possible."

Boulding went on in the same article to name no less than four non-traditional or non-economic forms of capital that he felt were subject to the principles he de-

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[1] Founding Director, Center for Sustainable Organizations; mmcelroy@vermontel.net

scribed: human capital, cultural capital, intellectual capital and geological capital, the last of which today is included in what we call natural capital. And while the non-geological/natural capitals Boulding listed cannot exist without production, we take his point.

To be clear, the capital-based theory of sustainability is simply this: that the sustainability performance of a human social system is a function of what its impacts on vital capitals are, relative to norms, standards or thresholds for what they would have to be in order to be sustainable (i.e., to maintain them at sufficient levels). With respect to impacts on natural capitals, this will generally involve the need to constrain consumption; for impacts on all other capitals, the imperative shifts to production, since human, social, constructed, economic and intellectual capitals are all largely anthropogenic anyway (see, for example, Costanza et al 1997, 123; McElroy 2008, 96-100).

Calibrating Capitals

If the sustainability performance of a social system is a function of what its impacts on capitals are relative to norms or standards for sufficiency, a question naturally arises as to how such impacts and sufficiency can be measured. And in cases where norms or standards are non-exclusive and are shared, how should the duty to abide by them be distributed or apportioned to multiple actors in a fair, just and proportionate way in the first place?

In the vocabulary of the capital-based theory of sustainability – also known as Context-Based Sustainability, or CBS (McElroy 2008, Ch. 3; McElroy and van Engelen 2012; Wikipedia 2023: Context-Based Sustainability, https://en.wikipedia.org/wiki/Context-Based_Sustainability) – these questions point to a distinction we can make between *thresholds* and *allocations*. And also to the concept of *carrying capacity* – or more specifically to the idea that all capitals can be quantified in terms of their corresponding carrying capacities (McElroy et al 2007; McElroy 2008, 2013).

The carrying capacity of a capital – where *capital* can also be understood as a term that is broadly synonymous with *resource* – is a measure of the level of demand it can support for its goods or services on a renewable, non-degrading basis. Human impacts on the climate system on Earth, for example, a form of natural capital, can exceed its carrying capacity by overwhelming it with more anthropogenic carbon dioxide than it can handle. In that case, the performance of the system, and the system itself, will degrade and the Earth will get hotter as we know too well.

Anthropogenic or "anthro" capitals, too, can degrade, although mainly from neglect. The ongoing sufficiency of anthro capitals, that is, depends on the degree to which they are regularly renewed or replenished by human efforts. The sufficiency of a healthcare system, for example – a blend of human, social, constructed, economic and intellectual capitals – depends entirely on the extent to which the population it serves keeps up with the need to maintain it. Fruit may grow on trees, but hospitals don't!

Calibrating or quantifying the carrying capacities of capitals depends on their nature. Whereas the carrying capacity of a hospital might be best expressed in terms of "staffed beds," the carrying capacity of the climate system on Earth might be better described in terms of metric tonnes of carbon dioxide, or the amount of greenhouse gases it can handle without putting the functional integrity of the system itself at risk.

The terms *thresholds* and *allocations* have also taken on special meaning in the vocabulary of CBS (McElroy et al 2007; McElroy 2008; McElroy and van Engelen 2012). Thresholds are limits – upper and lower ones – in the carrying capacities of capitals. For natural capitals, the thresholds of interest are upper ones, consisting of limits in the availability of natural resources, within which humans must live. For anthro capitals, it is lower limits, not upper ones, that matter most, since unlike natural capitals, anthro capitals are of our own making – whether or not they are sufficient depends on how much of them we produce (and reproduce). When taken together, then, upper limits or thresholds in

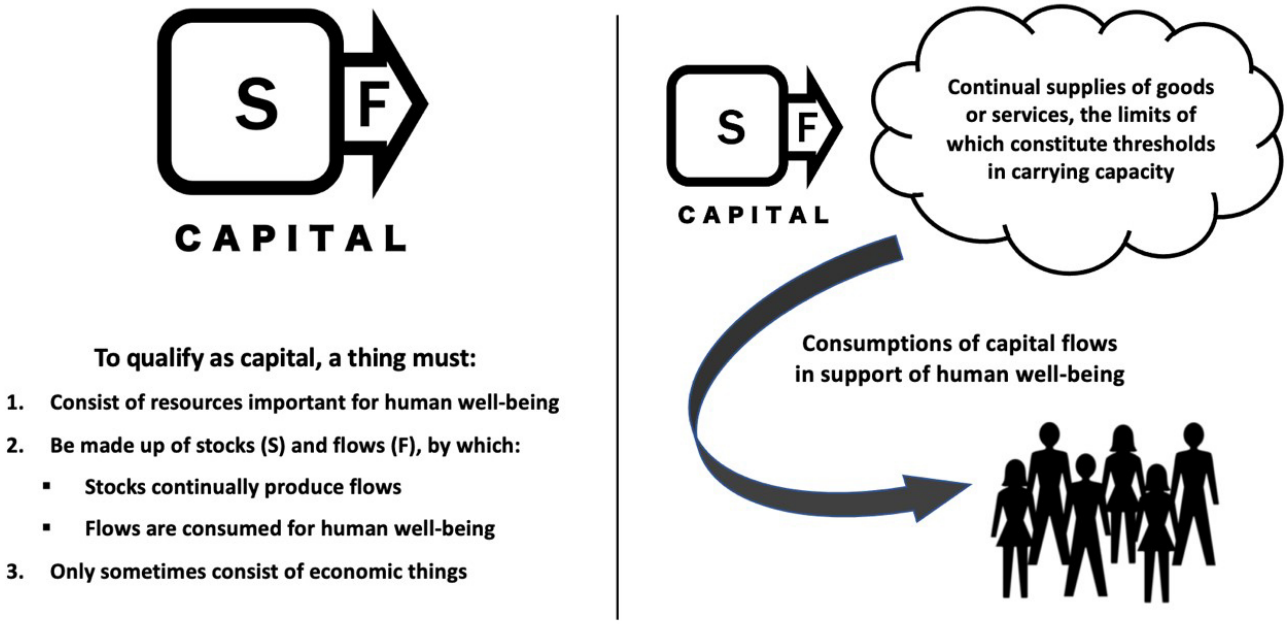


Figure 1 – The Ontology of Capital

the carrying capacities of natural capitals must not be exceeded, and lower limits or thresholds in the carrying capacities of anthro capitals must not be *re*ceded, or allowed to diminish. In other words, *we must live within our means and ensure the means to live*.[2] This is the normative sense in which the term "thresholds" is used in CBS.

Once targets or norms for thresholds in the carrying capacities of capitals have been identified, *allocations* must be defined for the human actors involved in maintaining them. Allocations are normative shares or degrees of responsibility to maintain vital capitals at sufficient levels (thresholds) to specific parties. In order to be legitimate, such allocations must, in turn, be fair, just and proportionate. In some cases, allocations to specific parties will comprise only a part of the overall responsibility to maintain a capital simply because the burden to do so is shared. In other cases, the burden to maintain a capital will be exclusive to just one party. Whereas the need for an organization to consume no more than its fair share of water resources in a watershed might be a good example of the first case, paying its employees no less than a living wage would be a good example of the second. This is the normative sense in which the term "allocations" is used in CBS.

Management Implications

To more clearly understand the manner in which the terms we are using here – thresholds, allocations, and carrying capacity – more about the capital construct and how these terms apply to it is needed. First should come a definition of the term *capital* itself:

> Capital is a stock of anything that yields a flow of valuable goods or services into the future (Costanza and Daly 1992, 38; Porritt 2005, 112; McElroy 2008, 95-6)

Capitals, then, are roughly synonymous with resources. They comprise *stocks* and *flows* of resources, that is, that humans and non-humans alike rely on for their well-being (see Figure 1). Human activities, impacts, and inactivities (i.e., failures to

[2] Coined in 2008 as the sustainability credo at Agri-Mark, Inc./Cabot Creamery Cooperative in Waitsfield, VT.

act where actions are required) that cause or permit the degradation of vital capitals to fall below sufficient or normative levels – either by over-consumption or under-production – are what we mean by *unsustainable* in CBS; those that have the opposite effect are *sustainable*. It is human activities and inactivities, then, and their corresponding impacts on the sufficiency of vital capitals, that are the referents of interest to us in the capital-based theory of sustainability.

Of central importance in capital theory is the idea that capitals are *productive resources* that continually produce valuable goods or services. The productive elements, in particular, are capital stocks; the goods or services they produce are their flows. The volume of flows produced by a capital, therefore, will always be a function of what the makeup of its stocks are, especially in terms of their substance, structure, dynamics, size and quality.

Here it should be clear that there is a causal relationship between stocks and flows in the sense that stocks cause or produce flows. If flows are insufficient from an instrumental perspective, one can either lower the demand for them or, in some cases, increase their supply. The first option is always available no matter what the type of capital is; the second, however, is only possible in cases where anthro capitals are involved. Natural capitals, that is, are given to us in fixed amounts – thermodynamically – the extent of which we can do little to change.

This is why in context- and capital-based sustainability management, or CBS, we take the position we do: that in order to improve performance in the case of impacts on natural capitals, one must always turn first to the idea of mitigating impacts on the carrying capacities of *flows*; for impacts on anthro capitals, by contrast, the range of possibilities expands to include interventions on stocks as well, since if flows from anthro capitals are in any way insufficient, the stocks themselves can always (or at least sometimes) be enlarged.

To see how these concepts will typically take shape, two illustrations of capital stocks and flows material to most organizations are shown in Figure 2, one involving natural capital and another social capital. As the illustrations show, capital stocks consist of accumulations of resources that, in turn, produce flows of valuable goods or services that people rely on – non-humans, too, in some cases. It is *flows*, in particular, then, that people consume or appropriate in order to meet their needs, the

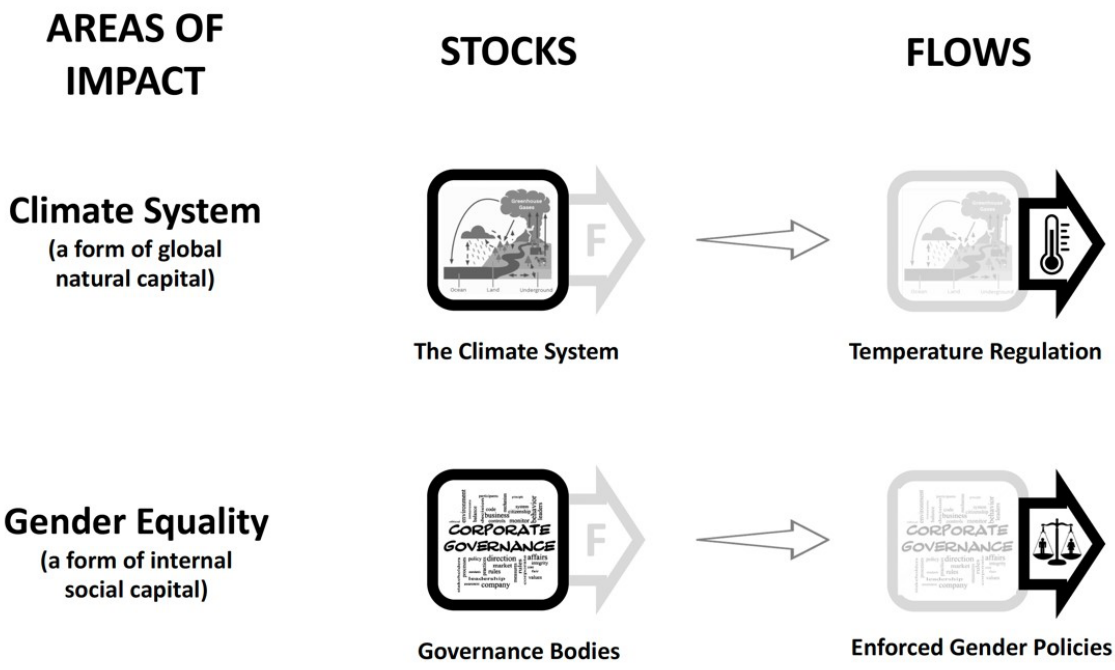


Figure 2 – Two Illustrations of Capital Stocks and Flows

quantity and quality of which may or may not be sufficient to sustain their well-being.

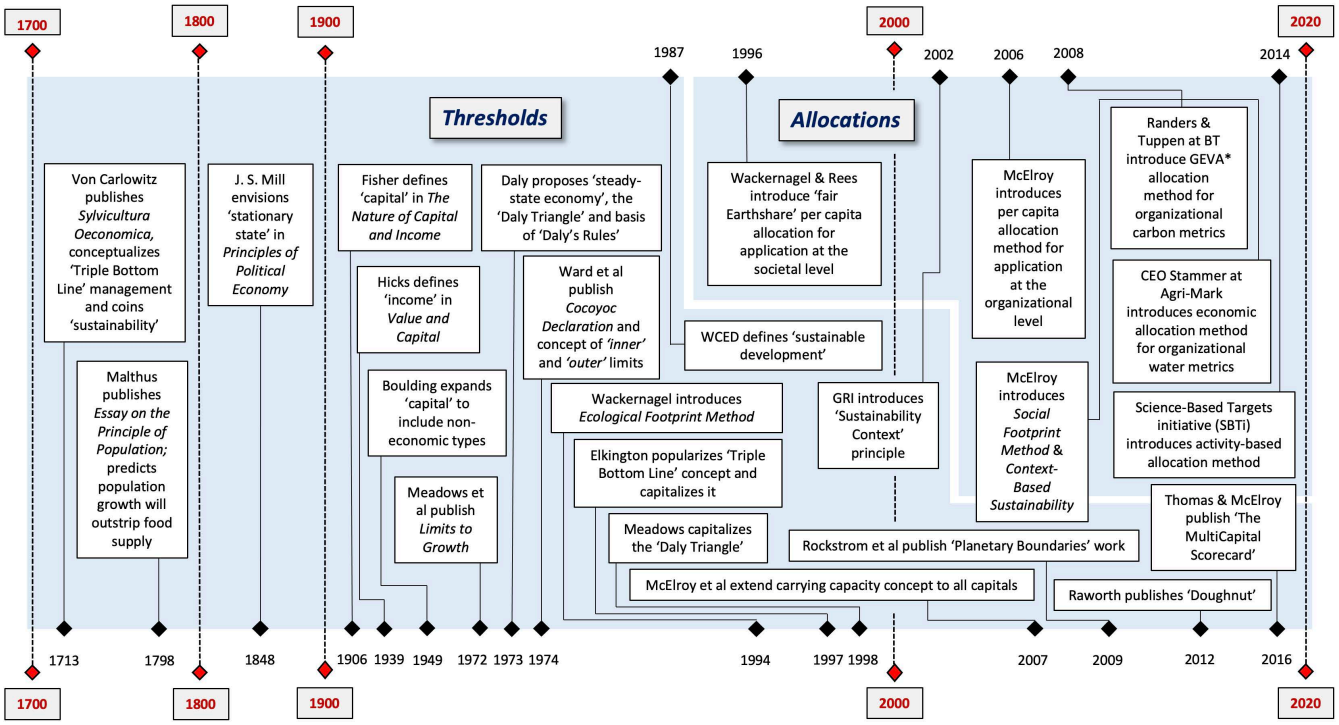
The climate system, for example – a vital form of natural capital – is composed of all the biological, geological, ecological and physical systems on Earth that interact with one another to regulate temperature and climate. The flows produced by the climate system stock, therefore, are the regulatory functions it provides – an ecosystem service of the most important kind to life on Earth.

Also shown in Figure 2 is an example involving gender equality. The relevant stock in that case is the governance function of an organization, which will typically be composed of a board of directors, its members, and the shared knowledge and procedures they rely on to do their work. As such, the governance function of an organization will usually be the source of enforced policies pertaining to gender and all other areas of ethical concern. As a stock, the governance function itself, then, is a form of social capital internal to an organization (i.e., a group of people working together to achieve a common goal). The enforced policies it produces, in turn, will be its flows, the scope and quality of which will determine the extent of gender equality and many other aspects of life in an organization.

History of Thresholds and Allocations

Figure 3 adds to the story being told here by providing a chronology of key developments in the intellectual history of thresholds and allocations. While seminal events in such a chronology are always hard to pin down, it seems fair to broadly attribute the birth of sustainability theory and practice (if only in the management literature) to Hans Carl von Carlowitz, who in 1713 published *Sylvicultura Oeconomica*, a handbook of sorts that arguably introduced the concept and practice of sustainable forestry (1713).

Core to Von Carlowitz's methodology was the idea that trees only grow so fast, and that if it is the preservation of forests as perpetual resources for wood that society wants, it should constrain the rate of harvesting to levels that do not exceed the rate at



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

Figure 3 – An Intellectual History of Thresholds and Allocations

(and their underlying foundations in capital theory; see Appendix for narrative annotations)

which trees grow. In our terms, forests and wood (lumber) are a form of natural capital, in which a forest itself is a stock and its annual growth of trees is a flow. The rate at which trees grow, then, is a threshold in the carrying capacity of a forest that ought not be exceeded by harvesting.

And while mentioned only once in Figure 3 in 2007, the concept of carrying capacity, too, has undergone a co-evolution of its own as uniquely reported by Nathan Sayre in his very fine article, "The Genesis, History, and Limits of Carrying Capacity" (2008). As Sayre points out, the origins of the term carrying capacity, while obscure, are most likely to be found in the history of engineering, mainly having to do with the specification of cargo holds in merchant ships. The same idea, however, would later appear in the ecological literature, in which the carrying capacity of an ecosystem would typically be defined, for example, as "the maximum population size that can be supported indefinitely by a given environment" (Begon et al 1996, 955).

Carrying capacity would only more recently emerge as a core principle in sustainability, including in an inverted sense (Rees 1992; Rees and Wackernagel 1994; Wackernagel and Rees 1996, 51-3). Instead of referring to the population size an environment can support, we can reverse the terms and specify the size an environment would have to be in order to support a population. Thus, we can speak of carrying capacity not only in terms of existing conditions, but in normative terms as well. In cases where the carrying capacities of capitals are largely a function of human design (i.e., for anthro capitals), this inverted sense of the concept has an important role to play, since the carrying capacities of anthro capitals are never just given to us in fixed supplies and instead are what we make of them.

Indeed, Sayre (2008, 120) seemed to have understood the value of carrying capacity to sustainability when he wrote, "Like sustainability—which it predates and in many ways anticipates—carrying capacity can be applied to almost any human–environment interaction, at any scale, and it has the additional advantage of conveying a sense of calculability and precision—something that sustainability thus far lacks." And whereas others in the field had long been making good use of the term in the environmental context, it would not be until 2007 and later that McElroy and his colleagues would extend the concept to all other non-environmental capitals as well (see, for example, McElroy et al 2007; McElroy 2008; McElroy and Van Engelen 2012; McElroy 2013; Thomas and McElroy 2016). All capitals have carrying capacities, they argued, the quantification of which – as Sayre noted – could revolutionize the practice of sustainability accounting.

As shown in Figure 3, most of the action in the evolution of thresholds and allocations unfolded first with respect to thresholds in the three-hundred-year period from the early eighteenth to early twenty-first centuries, with key developments in allocations not occurring until late in the twentieth century. It was then that we first started to see thresholds being translated into entity-specific shares or entitlements (i.e., allocations), albeit with respect to natural capital only (Wackernagel and Rees 1996, 54). But once McElroy and others had by 2007 successfully extended the concept to all other capitals as well, the possibility of defining fair, just and proportionate allocations of the responsibilities to maintain anthro capitals, too, was unleashed.

It is also critically important to mention here that it was not until John Elkington's triple bottom line work in the mid-nineties that the application of the capital-based theory of sustainability to *organizations* had been made (1994, 1997). Prior to that, all discussion of sustainability relative to the preservation of vital capitals had been applied at the macro level of whole social or economic systems only, usually in the context of sustainable development. To be clear, it was Elkington who first took steps to apply the idea to individual organizations. It was he, that is, who first suggested that in order to assess and manage the sustainability performance of organizations, one should focus in particular upon their impacts on vital capitals.

It would not be until some twelve or thirteen years later, though, that (a) the possibility of calibrating

all vital capitals in terms of their carrying capacities would be conceived, and (b) that methodologies for assigning fair, just and proportionate allocations of the responsibilities to maintain them would be developed (McElroy et al 2007; McElroy 2008). These subsequent developments, when coupled with Elkington's *capitalization* of the triple bottom line at the organizational level, and all that came before it in terms of capital theory in the preceding three hundred years, provided exactly the ingredients needed to produce what today we refer to as CBS, or more broadly, *context-based accounting*. Armed with an understanding of capital-based thresholds and allocations, then, it is now finally possible to operationalize triple bottom line accounting in ways that are applicable to individual organizations, and which take social, economic and environmental limits and thresholds in the world explicitly into account.

With regard to where things stand today in all this, research is expanding in the development of guidelines and principles for calculating thresholds and allocations, most notably in the form of the so-called Planetary Boundaries work (Rockstrom et al 2009) and the Science Based Targets Network (https://sciencebasedtargetsnetwork.org). At the same time, experimentation with alternative allocation methods – as in how best to make or determine them – continues to occur. At present, three alternative approaches are favored:

1. **Economic Allocations:** Proportionate assignments of fair shares of the responsibilities to maintain vital capitals in accordance with what an organization's contributions to GDP are, usually measured in terms of gross profits (aka, GEVA, or gross economic value added);
2. **Per Capita Allocations:** Proportionate assignments of fair shares of the responsibilities to maintain vital capitals in accordance with what an organization's workforce size is relative to a background population;
3. **Activity-Based Allocations:** Proportionate assignments of fair shares of the responsibilities to maintain vital capitals in accordance with what an organization's volume of output or production is relative to the overall output of its industry or sector.

While none of these allocation methods is without problems, they do make it possible in mechanically reliable ways to translate shared burdens into organization-specific assignments of responsibilities to maintain vital capitals in ways that are fair, just and proportionate. Without that and the kind of concurrent evolution we have seen in the intellectual history of thresholds and the carrying capacities of capitals, too, managing sustainability performance in human social systems in authentic and meaningful terms would not be possible.

Conclusions and Commentary

It is demonstrably the case that at no time in the short history of sustainability accounting – nor in the parallel evolution of Corporate Social Responsibility – has sustainability performance, per se, actually been measured, managed or reported in authentic or literal terms. This is largely due to the absence of core sustainability accounting principles, such as thresholds, allocations and carrying capacity in mainstream practice, until fairly recent times. It was not until the first decade of this century, in particular, that these concepts began to coalesce.

To be clear, these three principles (thresholds, allocations and carrying capacity) are all of a piece with the capital-based theory of sustainability, which interprets the sustainability performance of human social systems in terms of what their impacts on vital capitals are. The standard of performance or regulative ideal in all cases is sufficiency, since after all, the principles of thresholds and allocations only make sense if one first comes to see that the carrying capacities of vital capitals must be maintained at sufficient levels.

Thresholds, that is, are upper and lower limits in what the carrying capacities or magnitudes of capital flows are – and/or need to be – in order to sustain human (and non-human) well-being. And

whereas thresholds in natural capitals generally fall outside the control of human agency, thresholds in the other capitals (i.e., the anthropogenic ones) are almost entirely within it. The principles of thresholds and sufficiency therefore go hand-in-hand.

Allocations, for their part, are fair, just and proportionate shares of the responsibilities to maintain capitals (i.e., the sufficiency of their flows) that are assignable to individual actors. While hardly discussed here at all, it should be understood that such allocations can only legitimately be made to parties for whom related duties and obligations to maintain the capitals involved are held; otherwise their contributions, if any, are no more than discretionary or philanthropic (i.e., non-obligatory). This forms the basis of another key principle endemic to the CBS doctrine: *context-based materiality* (McElroy 2019).

Thanks to the co-evolution of the thresholds, allocations and carrying capacity principles in the past twenty years, important new developments of innovative context-based, triple bottom line, multi-capital performance accounting tools have also taken place, including the open-source MultiCapital Scorecard (Thomas and McElroy 2016; Thomas and McElroy LLC, The MultiCapital Scorecard: https://www.multicapitalscorecard.com); the LIFTS Accounting Model (Audencia Business School, Limits and Foundations Towards Sustainability Accounting Model" https://multi-capital-performance.audencia.com/en/research-and-studies/lifts-accounting-modelc/); and others. Their applications in practice thus far, however, have been largely experimental and impermanent, but the capabilities they bring to the table are no less game-changing and ready for mainstream use.

Despite the rigor and demonstrated validity of these concepts to sustainability accounting, none of the leading international standards for sustainability measurement and reporting, nor any of the ones currently in development (i.e., by the IFRS Foundation globally or EFRAG in the EU), take them properly into account. Indeed, the very idea of there being generally accepted accounting principles of an integrated financial/nonfinancial kind that can underlie sustainability and/or triple bottom line accounting is virtually nowhere to be found. Perhaps that explains why the competing standards for sustainability reporting in business are so different from one another, and why none of them manage to report sustainability in authentic or literal terms.

A handful of non-profits, however, are now starting to at least identify, document, and recommend such principles for widespread use as best they can (e.g., Center for Sustainable Organizations 2021, "Generally Accepted Integrated Accounting (GAIA) Principles: https://www.sustainableorganizations.org/GAIA-Principles.pdf; Social Accountability International, 2023, Triple Bottom Line (TBL) Certification: Toward a Common Standard for Measuring and Reporting Performance: https://sa-intl.org/programs/tbl/; Impact Management Foundation 2023, Thresholds and Allocations: https://impactmanagementplatform.org/thresholds-and-allocations/; United Nations Research Institute for Social Development (UNRISD) 2022, "Authentic Sustainability Assessment": https://cdn.unrisd.org/assets/library/reports/2022/manual-sdpi-2022.pdf; and r3.0. https://www.r3-0.org).

These and other important developments are a very good thing indeed, for how else are managers in organizations supposed to fulfill their fiduciary, moral and ethical responsibilities, if not by having access to accounting systems that faithfully report the effects of their organizations' activities and impacts in those terms? The fact that the leading standards-making bodies of the world – most of whom serve the narrow interests of investors only – have been so willing to ignore this does a great disservice to their constituents and to society as a whole. Indeed, managing for sustainability in the 21st century has become a moral imperative, and the fact that conventional accounting systems so grievously fail to report performance in those terms amounts to a dereliction of duty of pandemic proportions – or what McElroy and Thomas (2020) refer to as a "Planetary Accounting Emergency".

To the extent that we continue to rely on outdated accounting systems by which mistakes made

in the past (and present) remain hidden from view, we do nothing but condemn ourselves to repeat them. After all, those systems were never designed to report sustainability performance per se. And the fact that the financial community, whose obsession with profits is arguably what got us into the predicaments we face today (e.g., climate change, biodiversity loss, water shortages, plastics and novel entities pollution, economic inequities, refugee migrations, social unrest, etc.) is now spearheading global efforts to create new reporting standards that no less fail to address sustainability in authentic terms, would be laughable if it weren't so true. The fact that many of the same players, too, are at the same time falsely branding themselves in the halo effect of "sustainability" is even more outrageous. And to make things worse, we now also have the so-called ESG phenomenon (Environmental, Social and Governance), a particularly insidious form of faux sustainability reporting that openly encourages an interpretation of the subject that is nakedly shareholder centric and anything but authentic (UN Global Compact 2004; Freshfields Bruckhaus Deringer 2005; Simpson et al 2021).

We have finally arrived, it seems, at a fork in the road where we must either turn one way towards the preservation of shareholder primacy or another towards authentic sustainability and corporate responsibility. From where I sit, the decision is clear. The time has come to renounce the status quo and undertake reform in performance accounting so as to rid ourselves of the nearly suicidal effects of single bottom line thinking. And in its place must come the more rational, multi-bottom-line, multicapitalistic alternative (Center for Sustainable Organizations, Multicapitalism – A New Economic Doctrine for Sustainability in Commerce: https://www.sustainableorganizations.org/multicapitalism/). Indeed, what are we waiting for, things to get worse?

About the Author

Mark W. McElroy, PhD is the founding director of the Center for Sustainable Organizations, a former partner at KPMG, and board chair emeritus of the Donella Meadows Institute. He is particularly well known for his development of tools, methods, principles and metrics for measuring, managing and reporting the sustainability performance of organizations, including Context-Based Sustainability and Generally Accepted Integrated Accounting (GAIA) Principles. He is co-creator of the economic doctrine known as multicapitalism and co-author of the books, *Corporate Sustainability Management* (2012) and *The MultiCapital Scorecard: Rethinking Organizational Performance* (2016). Dr. McElroy lives with his wife in Woodstock, Vermont and can be reached at mmcelroy@vermontel.net.

About the Center for Sustainable Organizations

The Center for Sustainable Organizations (CSO) is a U.S.-based 501(c)(3) non-profit organization cre-ated in 2004 by its founder and Executive Director, Mark W. McElroy, PhD. Its purpose is to conduct research, development, training and consulting for, and with, organizations around the world ded-icated to sustainability in its most authentic, con-text-based form. What differentiates CSO from others in the field is its strong commitment to an approach to corporate sustainability accounting that interprets performance in terms of impacts on all vital capitals relative to organization-specific norms, standards or thresholds, and for the benefit of all stakeholders, not just some of them.

Appendix – Annotations of Figure 3: An Intellectual History of Thresholds and Allocations

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 put-ting 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 im-pacts 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, respec-tively.
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 deter-mining 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.

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 initia-tive 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: https://www.multicapitalism.com/Multicapitalism.pdf

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