

**This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.**

**Author(s):** El Geneidy, Sami; Kotiaho, Janne S.

**Title:** A planetary well-being accounting system for organizations

**Year:** 2024

**Version:** Published version

**Copyright:** © 2023 the Authors

**Rights:** CC BY-NC-ND 4.0

**Rights url:** <https://creativecommons.org/licenses/by-nc-nd/4.0/>

**Please cite the original version:**

El Geneidy, S., & Kotiaho, J. S. (2024). A planetary well-being accounting system for organizations. In M. Elo, J. Hytönen, S. Karkulehto, T. Kortetmäki, J. S. Kotiaho, M. Puurtinen, & M. Salo (Eds.), *Interdisciplinary Perspectives on Planetary Well-Being* (pp. 203-215). Routledge. <https://doi.org/10.4324/9781003334002-21>

# 15

## A PLANETARY WELL-BEING ACCOUNTING SYSTEM FOR ORGANIZATIONS

*Sami El Geneidy and Janne S. Kotiaho*

### Introduction

Unsustainable land use and overexploitation of natural resources to produce the consumables necessary to satisfy the needs and desires of humankind has compromised ecosystem integrity to a degree that in many places ecosystems are losing their ability to support the diversity of life (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2018; Willemsen *et al.*, 2020). Incremental changes in our production and consumption practices are unlikely to alleviate this state of affairs (Díaz *et al.*, 2019; IPBES, 2019), and we need to figure out ways to make considerable, even transformative changes that truly support the transition towards planetary well-being (Kortetmäki *et al.*, 2021).

We humans organize our everyday lives through organizations, be they private businesses or public services such as hospitals or education institutions. To understand organizations' role in enhancing or diminishing planetary well-being, we need to be able to identify and quantify the environmental impacts (*e.g.*, greenhouse gas emissions or biodiversity loss) their operations are causing. Although vital, such understanding alone is unlikely to facilitate the necessary transformative changes in production and consumption practices. Therefore, we argue here that a value-transforming integration of financial and environmental accounting and reporting is critical for ensuring that the environmental impacts really influence the management decisions of organizations.

As Schaltegger and Burritt (2000, p. 21) put it:

Conventional financial accounting provides the most important information management system for any company because it links all company activities with performance and expresses these in the form of a single unit

of account—money—which can be used as a basis for comparing available alternatives.

Financial accounting is generally recognized to be an objective information management system, but we often fail to notice how much power it actually holds in creating the premises and boundaries of an organization. It is the financial accounts that, for example, define what are included or excluded in assets and liabilities and how profit and loss are calculated, which consequently defines the size, health, structure, and performance of the organization (Hines, 1988). We do not dispute the usefulness of the conventional financial accounting. However, we do note that the convention of only including information related to flows of money neglects the more complex web of impacts organizations have on society and the environment, both of which are not customarily expressed as money within the boundaries of the organization. Indeed, conventional financial accounting has largely failed to steer organizations towards environmentally and societally sustainable decision-making (Laine *et al.*, 2020; Maas, Schaltegger and Crutzen, 2016; Nicholls, 2020; Veldman and Jansson, 2020).

Environmental accounting has been developed to make visible the impacts an organization has on the environment (Bracci and Maran, 2013; Schaltegger and Burritt, 2000; Unerman, Bebbington and O'dwyer, 2018). In their review on the history of academic work on environmental accounting, Russell, Milne, and Dey (2017) explain that before the 1990s the focus was on extending accounting systems so that traditional accounts could include environmental impacts beyond market transactions. Dominant themes were identifying, measuring, counting, and ultimately monetizing environmental costs and benefits, and then drawing them into the conventional financial accounts of organizations. Russell, Milne, and Dey (*ibid.*) make the observation that during the past two decades this stream of scholarly investigation has dwindled, and that monetizing the environment in financial accounts has not caught on. The case today is still that financial decision-making does not value negative or positive environmental impacts (Nedopil, 2022). Nevertheless, monetizing nature, despite widespread criticism of the notion (*e.g.*, Redford and Adams, 2009; Spash, 2015), appears to be a growing practice (Russell, Milne and Dey, 2017), with at least about 100 different solutions applied across the world (Hein, Miller and De Groot, 2013; Kotiaho *et al.*, 2016; Nedopil, 2022).

Environmental and social issues are profoundly complex; so too is the matter of accounting for them (Gray, 2001). Therefore, it is unsurprising that we have faced serious challenges when attempting to integrate environmental and social, never mind sustainability, impacts into conventional financial accounting. Predominantly the challenges seem to relate to issues of whether such impacts can be quantified (Gray, 2010; Norman and MacDonald, 2004; Pava, 2007). For example, Norman and MacDonald (2004) considered it to be a specious promise that we could ever measure, calculate, audit and report an organizations environmental and

social performance with the same rigour and detail as we can disclose its financial performance.

Although scholarly efforts to integrate environmental accounts with financial ones may have dwindled (Russell, Milne and Dey, 2017), non-financial disclosures and environmental accounts have become increasingly common. However, there is ample evidence that such non-financial environmental accounting remains isolated within organizations, and that even when it is included in reporting, it commonly remains unexploited in management decisions (Bracci and Maran, 2013; Maas, Schaltegger and Crutzen, 2016; Saravanamuthu, 2004; Veldman and Jansson, 2020). This observation indicates that simply mainstreaming environmental accounting across organizations is not enough. We think that a deep value-transforming integration of financial and environmental accounting is required to ensure that the disclosed environmental impacts capture the attention of the senior executives of the organizations. In other words, the depth of the integration needs to be such that the environmental accounts actually transform the value of the financial accounts.

Recently, Nicholls (2020) proposed that integrating financial, environmental, and social accounting should be a public policy solution. Before public policy can be implemented, however, some capacity building regarding how such integration might be done in practice is still needed. Although several methodologies towards integration of financial and environmental accounting have been developed (Maas, Schaltegger and Crutzen, 2016; Valliřová, Āerna and Hinke, 2018; Veldman and Jansson, 2020; empirical case studies: Alvarez, Blanquer and Rubio, 2014; Larsen *et al.*, 2013; Thurston and Eckelman, 2011), generalized applications for the integration remain scarce. This is especially the case for applications that highlight environmental impacts by transforming the value of the financial accounts at the organization level.

Here we will first focus on how environmental impacts can be identified and quantified by utilizing financial accounts and environmentally extended input-output databases. Our perspective is slightly different from previous attempts to integrate environmental and financial accounts (Russell, Milne and Dey, 2017) in that initially we do not directly monetize nature. Rather, we quantify the environmental impacts (*e.g.*, biodiversity loss) caused by the money spent in an organization and thus disclose its environmental performance through the financial accounts.

What should be noted, however, is that even when the environmental impacts are disclosed through the financial accounts (and thus, in principle, the environmental impacts are indirectly monetized), the disclosure itself does not transform the value of the financial accounts. To facilitate value transformation, which we consider to be critical for ensuring that the environmental impacts really influence the management decisions, we need to create money-based incentives for the senior executives. We believe that executives will pay attention when causing environmental damage costs money (or enhancing the state of the environment pays off) and will consequently begin to avoid and reduce the negative environmental impacts of their organizations and thus support the transition towards planetary

well-being. Therefore, in the proposed planetary well-being accounting system we will include an example in which biodiversity offsetting is used to concretely transform the value of the financial accounts. Noting that the financial performance of organizations is communicated through impact statements and balance sheets, we suggest that reporting as well should be developed towards integrated financial-environmental impact statements.

### **Integrating financial and environmental accounting**

Conventional financial accounting is an efficient system with respect to what it was made for: Tracking the financial flows of consumption (expenses and investments) and production (sales and revenue) within an organization. In other words, anything an organization consumes and produces should be visible in its financial accounts and all of its operations are at least indirectly touched upon by financial accounting. Therefore, financial accounts provide a promising platform for a deep value-transforming integration of financial and environmental accounts.

Integrating financial and environmental accounting basically requires that when an organization accounts for the impacts of its financial transactions, it should simultaneously account for the environmental impacts associated with those transactions. While the financial accounts might hold information about the price and type of a good or service, additional tools and information are needed to quantify the environmental impacts because they are currently not visible in conventional financial transactions. What is in particular needed is detailed information about the identity of products and services, which is not always readily available in current financial accounts. Thus, development work regarding what kind of information is reported in financial accounts, and particularly in receipts of transactions, needs to be undertaken so that information allowing the environmental impacts to be quantified becomes available. Information about the physical quantities and specific types of goods and services is vital for quantitative environmental accounting. What would help the process would be to require producers in all the steps of the supply chain to report on the environmental impacts of the goods and services they provide, so that the same information can be used further along the supply chain when the products are consumed by other organizations or end users.

Negative environmental impacts can be quantified in various ways but two methodologies stand out in the context of assessing environmental impacts of organizations: Environmentally extended input-output analysis (EEIOA) and life cycle assessment (LCA). Similar to any methodology, the accounts need first to be identified, meaning it needs to be determined what kinds of products or services the financial transactions in the accounts refer to. As already stated, the current financial accounting and reporting system does not necessarily need detailed information about the products and services, and therefore, in some cases, this identification is difficult or even impossible to complete (Bracci and Maran, 2013). After the account identification, a suitable methodology for the assessment of each

account's environmental impact can be chosen, based on whether the transactions of the specific account can best be quantified in terms of financial or physical units.

Generally, environmental impacts of financial accounts can be assessed by using EEIO databases, such as EXIOBASE, Eora, GTAP, and WIOD (for an introduction to the techniques, see Kitzes, 2013; Leontief 1970). For example, the biodiversity impact of procured information technology supplies can be assessed through an EEIO database by converting the unit of money spent in an organization (situated in a given country) into square meters of land used (in different ecosystems in different regions of the world) to produce the supplies. Land use can then be further converted into biodiversity impacts by utilizing another, for example LC-Impact, database (Verones *et al.*, 2020; El Geneidy *et al.*, 2021a,b; El Geneidy, Baumeister and Kotiaho, n.d.).

While EEIO operates predominantly on financial transactions, LCA databases, such as ecoinvent, LCA Commons and ELCD, can be used to assess the environmental impacts of different goods based on their physical consumption. An example of physical consumption better amenable to LCA than to EEIO methodology is the amount of megawatt hours of electricity consumed by an organization. More generally, physical consumption information about travel- and energy-related accounts is often readily available (El Geneidy *et al.*, 2021b; Larsen *et al.*, 2013), and consequently LCA-based approaches are more likely to deliver accurate results on environmental impacts than utilization of EEIO-based approaches on financial transactions alone.

A hybrid EEIO-LCA approach combines the strengths of both methodologies (Crawford *et al.*, 2018; Suh *et al.*, 2004; for applications see *e.g.*, El Geneidy *et al.*, 2021b; Larsen *et al.*, 2013; Marques *et al.*, 2017), and it may be that in the future we will see a stronger merger of the two approaches. It is worth noting that the process can be easily automated after the initial link between financial and environmental accounts has been constructed.

Even though the methodologies for assessing environmental impacts through both financial and physical consumption are already relatively well understood, from a practitioner's point of view the methods for utilizing financial accounts to calculate the environmental impacts of an organization are not yet readily available. In addition, information, especially about environmental impacts of physical consumption of goods, is in many cases still lacking, and this information is generally a prerequisite for LCA-based approaches. Also, while EEIO methodologies allow analysis of environmental impacts of different consumption sectors, they often cannot yet differentiate between two or more different products of the same sector (Stadler *et al.*, 2018).

### **Outlining financial-environmental impact statements**

Once the the link between financial and environmental accounts has been established, we can start developing a financial-environmental impact statement. These can then be utilized to communicate the financial as well as environmental

performance of the organization to the management of the organization, to other decision-makers such as investors, and to stakeholders such as non-governmental organizations.

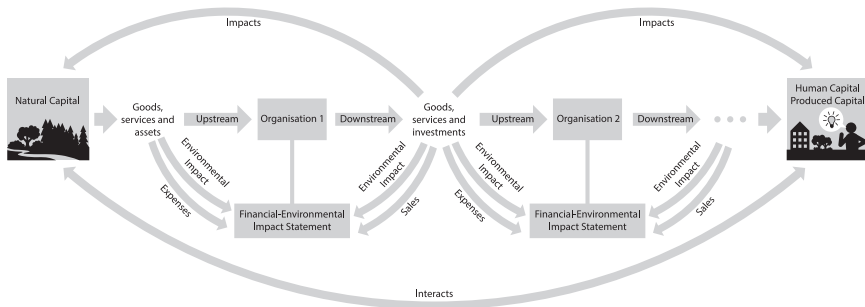
In financial accounting, relevant information is generally compiled in an income (or impact) statement and a balance sheet. An income statement describes the performance of an organization over a certain period with key figures such as revenue and expenses (Chen, 2022). A balance sheet on the other hand shows the assets and liabilities of an organization at a specific point of time, that is, what the organization owns and owes (Fernando, 2022). Here we use the income statement as a model because, after scrutinizing both, we concluded that it is the impact statement that contains most of the information needed for accounting the negative environmental impacts of an organization. Nevertheless, in the future it might also be useful to develop a balance sheet to allow accounting of the cumulative negative and positive environmental impacts the operations of an organization cause. Current financial impact statements only capture the flows of produced capital, but as Dasgupta (2021) has argued, we need to shift towards a system where the impact statement of an organization also captures the flows of natural capital (as well as human capital, which is not in the scope of the current chapter). In Table 15.1 we present an outline of the potential content of the financial-environmental impact statement following the guidelines of the International Financial Reporting Standards (IFRS) on the contents of a conventional financial income statement.

In Figure 15.1 we illustrate the overall idea of how natural capital is utilized and passed from one organization to another to create human and produced capital.

**TABLE 15.1** Potential content for the financial-environmental impact statement of an organization

	<i>Financial impact</i>	<i>Environmental impact</i>
Sales/downstream impact	Sales from operations	Negative and/or positive environmental impacts of the goods and services produced
Expenses/upstream impact	Expenses from operations	Negative environmental impacts of the goods and services consumed
Offsets	Financial value of offsets used to balance the negative environmental impacts	The quantity of offsets procured to balance the negative environmental impacts
Net impact	The net income (sales – expenses – offsets)	The net environmental impact (negative impacts – offsets)

We have included expenses from offsets to transform the value of the financial accounts. It is almost certain that even after careful avoidance of emissions and ecosystem degradation, not all negative environmental impacts can be evaded and hence organizations aiming for carbon neutrality and/or no net loss of biodiversity will have to resort to purchasing offsets.



**FIGURE 15.1** Visualization of financial and environmental flows relevant for the financial-environmental impact statement of an organization.

Assets any organization uses are called capital goods and have been classified into three different categories: Natural, human, and produced capital (e.g., Dasgupta, 2021). Natural capital is directly consumed as upstream goods and services in Organization 1, which are in turn transformed and sold as downstream goods and services to Organization 2 or used to create produced capital. From the perspective of Organization 2, goods and services from Organization 1 are upstream goods and services that are again transformed and used further along the supply chain as different products and services. Consuming natural capital to create produced capital generally has a negative impact on the environment either by causing emissions or reducing biodiversity. Organizations can also procure assets from natural capital or provide investments to other organizations or to produced capital. Finally, the goods and services satisfy the needs of organizations or individuals and contribute to human and produced capital, which in turn can interact with natural capital.

### Concluding remarks: The imperative of transforming financial value

If environmental information is not afforded the same value as financial information in decision-making, it can easily be ignored. In such situations the integration of financial and environmental accounting and reporting will not be sufficient to transform the operations of organizations and organizations will not become sensitive to the influence they have on planetary well-being. Indeed, our main thesis throughout this chapter has been that to truly make a difference in decision-making, environmental impacts uncovered by the integration of financial and environmental accounting and reporting need to transform the financial value.

Some initiatives are already piloting the financial valuation of environmental impacts, for example the so-called environmental profit and loss accounts (Høst-Madsen *et al.*, 2014; Schmidt and de Saxcé, 2016) and the social cost of carbon approach (Nordhaus, 2017). However, the valuation has not been deeply integrated into the financial accounts such that it would directly influence, that is transform,



the financial value. The environmental information has generally been presented only as additional information alongside conventional financial information (Nicholls, 2020). In the worst cases such reporting has been used to exploit the concept of sustainability to back up the dominant financial discourses of development and growth (Zappettini and Unerman, 2016).

It may be that integrating environmental and financial accounting, and especially transforming financial value based on environmental impacts, is an issue that is best tackled by public policy (Nicholls, 2020). Important steps towards this goal have already been taken, for instance in the European Union (EU) with the adoption of the Corporate Sustainability Reporting Directive (CSRD) which builds upon an earlier Non-Financial Reporting Directive (Council of the EU, 2022a). In addition, the EU aims to scale up sustainable investments by classifying the sustainability criteria of economic activities for investors (European Commission, 2022a). While the EU taxonomy will include mandatory reporting requirements (connecting to the CSRD), it is up to the businesses to decide whether they want to apply for eligibility within the investment regime, and up to investors to decide whether they want to direct investments based on sustainability criteria. That said the possible adoption of a carbon border adjustment mechanism that puts a tax on certain goods imported to the EU based on their assessed climate impact (Council of the EU, 2022b) will also influence the financial accounting values of supply chains in organizations. Furthermore, some progressive corporations and financial institutions are actually calling for governments of the world to legislate mandatory disclosure of nature-related impacts and dependencies for businesses (Business for Nature, Capitals Coalition and CDP, 2022). Unfortunately, it seems that the current political initiatives aim to entrench the existing trend of environmental accounting as a separate aspect of corporate reporting, and we do not yet see any meaningful steps towards value-transforming integrated financial and environmental accounting.

As the value-transforming integration of financial and environmental accounting outlined here can be replicated in any organization with standardized financial accounts, we conclude that such integration offers a platform that could be used to initiate a truly transformative change in the management of organizations, one that supports the transition towards planetary well-being. We note, however, that the mere existence of the platform does not guarantee that the integrated reporting or the value transformation will be adopted by organizations. Indeed, there is evidence that voluntary reporting is not as effective as mandatory reporting (Crawford and Williams, 2010; see also Gray, 2001; Hess, 2007; Koehler, 2007; Wu and Babcock, 1999), and that value-transforming economic instruments to protect biodiversity, including biodiversity offset programs, do not and cannot operate without robust regulation and state involvement (Boisvert, 2015; Koh, Hahn and Boonstra, 2019; Koh, Hahn and Ituarte-Lima, 2017; Kujala *et al.*, 2022; Vatn, 2015). Therefore, we adopt the view that strong public oversight might be needed and offer two suggestions. First, make the integration of financial and environmental accounting

mandatory for all organizations with financial disclosure obligations. Second, make the environmental impacts salient to the senior executives of the organizations by transforming the value of financial accounts on the basis of environmental impacts. This can be done for example by introducing mandatory biodiversity offsetting schemes (see *e.g.*, Moilanen and Kotiaho, 2018, 2021), new environmental protection taxes and subsidies, or some other instruments that have the potential to transform the value of the financial accounts. Perhaps it is worth noting that we are currently witnessing a shift away from policies that use offsets to balance environmental impacts, and moving towards political interventions that aim for net positive environmental impacts (Leclère *et al.*, 2020; Moilanen and Kotiaho, 2021; the Convention on Biological Diversity (CBD), 2022).

In this chapter, we focused exclusively on the integration of financial and environmental accounting. With a methodology analogous to the one outlined here for the accounting of environmental impacts of organizations, it might be possible to begin to quantitatively account at least some of the social impacts of the financial accounts of organizations. Quantitative accounting of both environmental and social impacts of financial accounts would be in line with the current political development in the EU towards a Corporate Sustainability Due Diligence Directive (European Commission, 2022b). Whether mechanisms such as offsets or taxes and subsidies can be innovated to transform the value of the financial accounts based on social impact accounts remains to be seen. Although we think the deep value-transforming integration of environmental accounts with financial accounts as outlined here is a critical step forward, the integration of social impacts and human capital is also needed. Once this step is taken, we may be close to a truly transformative planetary well-being accounting system.

## References

- Alvarez, S., Blanquer, M. and Rubio, A. (2014) 'Carbon footprint using the Compound Method based on Financial Accounts. The case of the School of Forestry Engineering, Technical University of Madrid', *Journal of Cleaner Production*, 66, pp. 224–232. <https://doi.org/10.1016/j.jclepro.2013.11.050>
- Boisvert, V. (2015) 'Conservation banking mechanisms and the economization of nature: An institutional analysis', *Ecosystem Services*, 15, pp. 134–142. <https://doi.org/10.1016/j.ecoser.2015.02.004>
- Bracci, E. and Maran, L. (2013) 'Environmental management and regulation: Pitfalls of environmental accounting?', *Management of Environmental Quality: An International Journal*, 24, pp. 538–554. <https://doi.org/10.1108/MEQ-04-2012-0027>
- Business for Nature, Capitals Coalition and CDP (2022) *Make It Mandatory: the case for mandatory corporate assessment and disclosure on nature*. Available at: <https://www.businessfornature.org/make-it-mandatory-campaign> (Accessed: 27 January 2023).
- CBD (2022) *Kunming-Montreal Global Biodiversity Framework*. CBD/COP/DEC/15/4. Available at: <https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf> (Accessed: 27 January 2023).

- Chen, J. (2022) *Income Statement: How to Read and Use It*. Available at: <https://www.investopedia.com/terms/i/incomestatement.asp> (Accessed: 27 January 2023).
- Council of the EU (2022a) ‘Council gives final green light to corporate sustainability reporting directive’, press release, 28 November. Available at: <https://www.consilium.europa.eu/en/press/press-releases/2022/11/28/council-gives-final-green-light-to-corporate-sustainability-reporting-directive/> (Accessed: 27 January 2023).
- Council of the EU (2022b) ‘Council agrees on the Carbon Border Adjustment Mechanism (CBAM)’, press release, 15 March. Available at: <https://www.consilium.europa.eu/en/press/press-releases/2022/03/15/carbon-border-adjustment-mechanism-cbam-council-agrees-its-negotiating-mandate/> (Accessed: 27 January 2023).
- Crawford, E.P. and Williams, C.C. (2010) ‘Should corporate social reporting be voluntary or mandatory? Evidence from the banking sector in France and the United States’, *Corporate Governance: International Journal of Business in Society*, 10(4), pp. 512–526. <https://doi.org/10.1108/14720701011069722>
- Crawford, R.H. *et al.* (2018) ‘Hybrid life cycle inventory methods – A review’, *Journal of Cleaner Production*, 172, pp. 1273–1288. <https://doi.org/10.1016/J.CLEPRO.2017.10.176>
- Dasgupta, P. (2021) *The Economics of Biodiversity: The Dasgupta Review*. London: HM Treasury. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/962785/The\\_Economics\\_of\\_Biodiversity\\_The\\_Dasgupta\\_Review\\_Full\\_Report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962785/The_Economics_of_Biodiversity_The_Dasgupta_Review_Full_Report.pdf) (Accessed: 27 January 2023).
- Diaz, S. *et al.* (2019) ‘Pervasive human-driven decline of life on Earth points to the need for transformative change’, *Science*, 366, eaax3100. <https://doi.org/10.1126/science.aax3100>
- El Geneidy, S. *et al.* (2021a) *Sustainability for JYU: Jyväskylän yliopiston ilmasto- ja luontohaitat*. Wisdom Letters, 2/2021. Available at: [https://jyx.jyu.fi/bitstream/handle/123456789/75182/1/wisdom\\_letters\\_2-21\\_valmis\\_230421\\_web.pdf](https://jyx.jyu.fi/bitstream/handle/123456789/75182/1/wisdom_letters_2-21_valmis_230421_web.pdf) (Accessed: 27 January 2023).
- El Geneidy, S. *et al.* (2021b) ‘The carbon footprint of a knowledge organization and emission scenarios for a post-COVID-19 world’, *Environmental Impact Assessment Review*, 91, 106645. <https://doi.org/10.1016/j.eiar.2021.106645>
- El Geneidy, S., Baumeister, S. and Kotiaho, J.S. (n.d.) ‘Value-transforming integration of financial and environmental accounting in organizations’ [Manuscript in preparation].
- European Commission (2022a) *EU Taxonomy for Sustainable Activities*. Available at: [https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities\\_en](https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en) (Accessed: 27 January 2023).
- European Commission (2022b) ‘Just and sustainable economy: Commission lays down rules for companies to respect human rights and environment in global value chains’, press release, 23 February. Available at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_22\\_1145](https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1145) (Accessed: 27 January 2023).
- Fernando, J. (2022) *Balance Sheet: Explanation, Components, and Examples*. Available at: <https://www.investopedia.com/terms/b/balancesheet.asp> (Accessed: 27 January 2023).
- Gray, R. (2001) ‘Thirty years of social accounting, reporting and auditing: what (if anything) have we learnt?’, *Business Ethics: A European Review*, 10, pp. 9–15. <http://dx.doi.org/10.1111/1467-8608.00207>
- Gray, R. (2010) ‘Is accounting for sustainability actually accounting for sustainability... and how would we know? An exploration of narratives of organisations and the planet’, *Accounting, Organizations and Society*, 35, pp. 47–62. <https://doi.org/10.1016/j.aos.2009.04.006>

- Hein, L., Miller, D.C. and De Groot, R. (2013) 'Payments for ecosystem services and the financing of global biodiversity conservation', *Current Opinion in Environmental Sustainability*, 5(1), pp. 87–93. <https://doi.org/10.1016/j.cosust.2012.12.004>
- Hess, D. (2007) 'Social reporting and new governance regulation: the prospects of achieving corporate accountability through transparency', *Business Ethics Quarterly*, 17(3), pp. 453–476. <https://doi.org/10.5840/beq200717348>
- Hines, R.D. (1988) 'Financial accounting: In communicating reality, we construct reality', *Accounting, Organizations and Society*, 13, pp. 251–261. [https://doi.org/10.1016/0361-3682\(88\)90003-7](https://doi.org/10.1016/0361-3682(88)90003-7)
- Høst-Madsen, N.K. et al. (2014) *Novo Nordisk's Environmental Profit and Loss Account 2014*. The Danish Environmental Protection Agency. Available at: <https://www2.mst.dk/udgiv/publications/2014/02/978-87-93178-02-1.pdf> (Accessed: 27 January 2023).
- IPBES (2018) Summary for policymakers of the assessment report on land degradation and restoration of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Zenodo. <https://doi.org/10.5281/zenodo.3237411>
- IPBES (2019) Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Zenodo. <https://doi.org/10.5281/zenodo.3553579>
- Kitzes, J. (2013) 'An introduction to environmentally-extended input-output analysis', *Resources*, 2(4) pp. 489–503. <https://doi.org/10.3390/resources2040489>
- Koehler, D.A. (2007) 'The effectiveness of voluntary environmental programs—A policy at a crossroads?', *Policy Studies Journal*, 35, pp. 689–722. <https://doi.org/10.1111/j.1541-0072.2007.00244.x>
- Koh, N.S., Hahn, T. and Boonstra, W.J. (2019) 'How much of a market is involved in a biodiversity offset? A typology of biodiversity offset policies', *Journal of Environmental Management*, 232, pp. 679–691. <https://doi.org/10.1016/j.jenvman.2018.11.080>
- Koh, N.S., Hahn, T. and Ituarte-Lima, C. (2017) 'Safeguards for enhancing ecological compensation in Sweden', *Land Use Policy*, 64, pp. 186–199. <https://doi.org/10.1016/j.landusepol.2017.02.035>
- Kortetmäki, T. et al. (2021) 'Planetary well-being', *Humanities and Social Sciences Communications*, 8, p. 258. <https://doi.org/10.1057/s41599-021-00899-3>
- Kotiahio, J.S. et al. (2016) *Framework for Assessing and Reversing Ecosystem Degradation – Report of the Finnish Restoration Prioritization Working Group on the Options and Costs of Meeting the Aichi Biodiversity Target of Restoring at least 15 Percent of Degraded Ecosystems in Finland*. Reports of the Ministry of the Environment, 15en. Helsinki. Available at: [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/74862/YMre\\_15en\\_2016.pdf?sequence=1&isAllowed=y](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/74862/YMre_15en_2016.pdf?sequence=1&isAllowed=y) (Accessed: 27 January 2023).
- Kujala, H. et al. (2022) 'Credible biodiversity offsetting needs public national registers to confirm no net loss', *One Earth*, 5, pp. 650–662. <https://doi.org/10.1016/j.oneear.2022.05.011>
- Laine, M. et al. (2020) 'Special issue editorial: Social and environmental account/ability 2020 and beyond', *Social and Environmental Accountability Journal*, 2245. <https://doi.org/10.1080/0969160X.2020.1733631>
- Larsen, H.N. et al. (2013) 'Investigating the carbon footprint of a university – The case of NTNU', *Journal of Cleaner Production*, 48, pp. 39–47. <https://doi.org/10.1016/j.jclepro.2011.10.007>
- Leclère, D. et al. (2020) 'Bending the curve of terrestrial biodiversity needs an integrated strategy', *Nature*, 585, pp. 551–556. <https://doi.org/10.1038/s41586-020-2705-y>

- Leontief, W. (1970) 'Environmental repercussions and the economic structure: An input-output approach', *The Review of Economics and Statistics*, 52, pp. 262–271. <https://doi.org/10.2307/1926294>
- Maas, K., Schaltegger, S. and Crutzen, N. (2016) 'Integrating corporate sustainability assessment, management accounting, control, and reporting', *Journal of Cleaner Production*, 136, pp. 237–248. <https://doi.org/10.1016/j.jclepro.2016.05.008>
- Marques, A. *et al.* (2017) 'How to quantify biodiversity footprints of consumption? A review of multi-regional input–output analysis and life cycle assessment', *Current Opinion in Environmental Sustainability*, 29, pp. 75–81. <https://doi.org/10.1016/j.cosust.2018.01.005>
- Moilanen, A. and Kotiaho, J.S. (2018) 'Fifteen operationally important decisions in the planning of biodiversity offsets', *Biological Conservation*, 227, pp. 112–120. <https://doi.org/10.1016/j.biocon.2018.09.002>
- Moilanen, A. and Kotiaho, J.S. (2021) 'Three ways to deliver a net positive impact with biodiversity offsets', *Conservation Biology*, 35, pp. 197–205. <https://doi.org/10.1111/cobi.13533>
- Nedopil, C. (2022) 'Integrating biodiversity into financial decision-making: Challenges and four principles', *Business Strategy and the Environment*, early view. <https://doi.org/10.1002/bse.3208>
- Nicholls, J.A. (2020) 'Integrating financial, social and environmental accounting', *Sustainability Accounting, Management and Policy Journal*, 11(4), pp. 745–769. <https://doi.org/10.1108/SAMPJ-01-2019-0030>
- Nordhaus, W.D. (2017) 'Revisiting the social cost of carbon', *PNAS*, 114, pp. 1518–1523. <https://doi.org/10.1073/pnas.1609244114>
- Norman, W. and MacDonald, C. (2004) 'Getting to the bottom of "Triple Bottom Line"', *Business Ethics Quarterly*, 14, pp. 243–262. <http://dx.doi.org/10.2307/3857909>
- Pava, M.L. (2007) 'A response to "getting to the bottom of "triple bottom line"', *Business Ethics Quarterly*, 17(1), pp. 105–110. <http://dx.doi.org/10.2307/27673160>
- Redford, K.H. and Adams, W.M. (2009) 'Payment for ecosystem services and the challenge of saving nature', *Conservation Biology*, 23, pp. 785–787. <https://doi.org/10.1111/j.1523-1739.2009.01271.x>
- Russell, S., Milne, M.J. and Dey, C. (2017) 'Accounts of nature and the nature of accounts: Critical reflections on environmental accounting and propositions for ecologically informed accounting', *Accounting, Auditing & Accountability Journal*, 30, pp. 1426–1458. <https://doi.org/10.1108/AAAJ-07-2017-3010>
- Saravanamuthu, K. (2004) 'What is measured counts: Harmonized corporate reporting and sustainable economic development', *Critical Perspectives on Accounting*, 15(3), pp. 295–302. [https://doi.org/10.1016/S1045-2354\(03\)00063-7](https://doi.org/10.1016/S1045-2354(03)00063-7)
- Schaltegger, S. and Burritt, R. (2000) *Contemporary Environmental Accounting: Issues, Concepts and Practice*. 1st edn. London: Routledge. <https://doi.org/10.4324/9781351282529>
- Schmidt, J.H. and de Saxcé, M. (2016) *Arla Foods Environmental Profit and Loss Accounting 2014*. The Danish Environmental Protection Agency. Available at: <http://eng.mst.dk/media/176132/arla-foods-epl.pdf> (Accessed: 27 January 2023).
- Spash, C.L. (2015) 'Bulldozing biodiversity: The economics of offsets and trading-in nature', *Biological Conservation*, 192, pp. 541–551. <https://doi.org/10.1016/j.biocon.2015.07.037>
- Stadler, K. *et al.* (2018) 'EXIOBASE 3: Developing a time series of detailed environmentally extended multi-regional input-output tables', *Journal of Industrial Ecology*, 22(3), pp. 502–515. <https://doi.org/10.1111/jiec.12715>

- Suh, S. *et al.* (2004) 'System boundary selection in life-cycle inventories using hybrid approaches', *Environmental Science and Technology*, 38, pp. 657–664. <https://doi.org/10.1021/es0263745>
- Thurston, M. and Eckelman, M.J. (2011) 'Assessing greenhouse gas emissions from university purchases', *International Journal of Sustainability in Higher Education*, 12, pp. 225–235. <https://doi.org/10.1108/14676371111148018>
- Unerman, J., Bebbington, J. and O'dwyer, B. (2018) 'Corporate reporting and accounting for externalities', *Accounting and Business Research*, 48(5), pp. 497–522. <https://doi.org/10.1080/00014788.2018.1470155>
- Valliřová, L., Černá, M. and Hinke, J. (2018) 'Implementation of sustainability aspects in the financial reporting system: An environmental accounting standard', *Economic Annals*, XXI, 173(9–10), pp. 55–59. <https://doi.org/10.21003/ea.V173-09>
- Vatn, A. (2015) 'Markets in environmental governance. From theory to practice', *Ecological Economics*, 117, pp. 225–233. <https://doi.org/10.1016/j.ecolecon.2014.07.017>
- Veldman, J. and Jansson, A. (2020) 'Planetary boundaries and corporate reporting: The role of the conceptual basis of the corporation', *Accounting, Economics and Law: A Convivium*, 20180037. <https://doi.org/10.1515/acl-2018-0037>
- Veronesi, F. *et al.* (2020) 'LC-IMPACT: A regionalized life cycle damage assessment method', *Journal of Industrial Ecology*, 24(6), pp. 1201–1219. <https://doi.org/10.1111/jiec.13018>
- Willemsen, L. *et al.* (2020) 'How to halt the global decline of lands', *Nature Sustainability*, 3, pp. 164–166. <https://doi.org/10.1038/s41893-020-0477-x>
- Wu, J. and Babcock, B.A. (1999) 'The relative efficiency of voluntary vs mandatory environmental regulations', *Journal of Environmental Economics and Management*, 38(2), pp. 158–175. <https://doi.org/10.1006/jjeem.1999.1075>
- Zappettini, F. and Unerman, J. (2016) "'Mixing' and 'Bending': The recontextualisation of discourses of sustainability in integrated reporting", *Discourse and Communication*, 10(5), pp. 521–542. <https://doi.org/10.1177/1750481316659175>