GREENHOUSE GAS ACCOUNTING AND NET–ZERO TARGET SETTING – THE CASE FOR ORGANISATIONAL GHG DOUBLE–ENTRY BOOKKEEPING

JOEL HOUDET[1], FABIEN QUETIER[2], PRAVIR DESHMUKH[3], JILL ATKINS[4]

POSITION PAPER

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UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

10 YEARS ALBERT LUTHULI LEADERSHIP INSTITUTE

1. Albert Luthuli Leadership Institute, Department of Business Management, University of Pretoria, South Africa
2. Biotope, France
3. CII India Business & Biodiversity Initiative, India
4. Sheffield University Management School, United Kingdom

Contributors / Reviewers: Young-Jin Choi, Carl Obst, Robert Houdet.

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1. SETTING THE SCENE

1.1 THE CLIMATE EMERGENCY AND NET-ZERO TARGETS

The IPCC (2018) Special Report on Global Warming (SR15)[1] provided a clear warning message. We must limit global temperature rise to 1.5°C above pre-industrial levels and reach net-zero greenhouse gas (GHG) emissions by 2050 for the best chance of avoiding catastrophic climate breakdown[2]. This helped drive the number of organisations (e.g. corporations, NGOs, cities) committing to reach net-zero emissions. However, not all net-zero targets are equal.

To help provide clarity on how best to strive for 1.5°C pathways, Version 1.0 of the SBTi Corporate Net-Zero Standard[3] was launched in October 2021. It provides guidance, criteria, and recommendations to support organisations in setting Science-Based-Targets (SBTs) for climate. SBTs aim to address cumulative GHG footprints above pre-industrial levels and can be differentiated according to three successive phases[4]:

- Near-term GHG emission reductions (5 to 10 years), which are target year-dependent (informed by mitigation pathways),
- Long-term GHG emission reductions, which are aligned with net-zero at the sector or global level (target year-independent),
- Reaching periodic net zero emissions by 2050 at the latest.

These phases are based on the SBTi's modelling that allocates a budget to an organisation based on its circumstances. While there are variations, the modeling typically starts with the 1.5°C target and then determines a realistic reduction goal based on the unique circumstances of the organisation's sector. This modelling accounts for the cumulative emissions of all organisations and provides organisation-specific periodic targets. While the sum of periodic emissions represents the total emissions budget available to the organisation towards net-zero (i.e. cumulative GHG emissions allowed by SBTi), the periodic targets set the rate of emissions reductions or emissions intensity reductions that are required in a specific period.

1. URL: https://www.ipcc.ch/sr15/

2. Climate change is already affecting every region on Earth, its impacts increasingly visible in the form of extreme weather, worsened droughts, and heightened risk of forest fires (IPCC 2021, Sixth Assessment Report – URL: https://www.ipcc.ch/report/ar6/wg1/)

3. URL: https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf

4. According to the SBTi Corporate Net-Zero Standard, "For near-term science-based targets, mitigation pathways inform the rate of emissions reductions or emissions intensity reductions that are needed. For long-term science-based targets, they inform the overall emissions reduction or convergence intensity that must be reached to be aligned with net-zero at the global or sector level. Because of this, near-term science-based targets are target year-dependent, while long-term science-based targets are target year-independent. This means that a company's reduction target will differ depending on the target year for its near-term targets, but the reduction target will not differ depending on the target year for its long-term targets."

1.2 GHG ACCOUNTING AND DISCLOSURE FRAMEWORKS ALSO NEED TO EXPLICITLY RECORD CUMULATIVE EMISSIONS AND REMOVALS

Current critique of GHG accounting and disclosure frameworks and associated organisational practices focus primarily on their lack of systematization and comparability, particularly for emissions along the value chain (so-called scope 3)[5]. Incomplete accounts of cumulative / accumulated GHG emissions and removals at the organisational level may lead to greenwashing practices, as organisations fail to take responsibility for their true GHG footprints or adopt inadequate climate goals.

While this is a significant issue, this paper is concerned with addressing a gap which has yet to be explicitly conceptualized: i.e. the need for such frameworks to adopt an accounting system that explicitly record and track cumulative GHG emissions and removals over time. Since most organisations understand the cumulative nature of their GHG emissions, it is puzzling to realize that none disclose their accumulated emissions at the time of reporting[6]. While there is no clear explanation for the focus on periodic GHG emissions, existing GHG accounting and disclosure frameworks (and hence the SBTi) currently use something akin to a single-entry bookkeeping system (SEBK), whereby GHG emissions and removals are merely added up over time.

Because the rigor and completeness of GHG accounting directly influences an organisation's ability to manage and disclose their climate-related risks, GHG accounting and disclosure frameworks could adopt more sophisticated accounting practices, improving risk management and transparency. Accordingly, to support the SBTi Corporate Net-Zero Standard, this paper proposes new conventions to double-entry bookkeeping (DEBK) to help formalize the accounting of cumulative GHG emissions and removals and help improve the:

- GHG accounting frameworks, such as the GHG Protocol Corporate Accounting and Reporting Standard[7] and the GHG Protocol for Cities[8], and
- GHG reporting and disclosure frameworks, such as CDP[9], CDSB[10] and GRI[11].

5. E.g., Klaaßen, L., Stoll, C. Harmonizing corporate carbon footprints. Nat Commun 12, 6149 (2021). https://doi.org/10.1038/s41467-021-26349-x
6. Very few initiatives track the cumulative emissions of individual organisations and make their findings public. For instance, see the Carbon Majors Database CDP Carbon Majors Report 2017; URL: https://cdn.cdp.net/cdp-production/cms/reports/documents/000/002/327/original/Carbon-Majors-Report-2017.pdf?1501833772
7. URL: https://ghgprotocol.org/corporate-standard
8. URL: https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities
9. URL: https://www.cdp.net/en
10. URL: https://www.cdsb.net/
11. URL: https://www.globalreporting.org/

1.3 ORGANISATIONAL DOUBLE-ENTRY BOOKKEEPING (DEBK)

The concept of DEBK comes from financial accounting and was first popularized in the late 13th century by Luca Pacioli, who formalized the long-established accounting methods practiced by Venetian traders to keep track of their intricate web of transactions. With DEBK, every financial event involves recording each transaction in an account with an equal and opposite effect in at least one other account. These transactions are summarized in the preparation of financial statements, including the Statement of Financial Position (or Balance Sheet) and the Statement of Financial Performance (or Profit & Loss Statement), which are based on two inter-dependent equations (Box 1). DEBK thus enables organisations to record both periodic and cumulative changes in transactions of a financial nature and to aggregate individual financial events at the organisational level. Because accounting journal entries must balance out, DEBK reduces the likelihood of errors and frauds and helps improve transparency and financial management (Trotman & Gibbins, 2003)[12].

Box 1: Reminder / The equations for the Statements of Financial Position and Performance

Equation of the Statement of Financial Position (Balance Sheet):
Assets = Liabilities + Owners' Equity.

Equation of the Statement of Financial Performance (Profit & Loss Statement):
Profit/Loss = Revenues – Expenses.

DEBK's conceptual foundations have recently been applied to another form of organisational capital, namely renewable natural capital (Houdet *et al.*, 2021[13]). The primary goal is to move away from annual marginal positive and / or negative impact measurements and disclosures towards measuring the net accumulated changes in the state of biodiversity[14] impacted by organisations over time. Notably, through Biodiversity Statements of Position (i.e. accumulated impacts) and Performance (net annual impact), the Biological Diversity Protocol (2021)[15] provides a standardized DEBK-based framework for organisational biodiversity footprint assessments. It is being applied by a growing number of organisations worldwide.

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12. K. Trotman M. Gibbins Financial accounting: An integrated approach. 2nd edition 2003, Thomson Nelson Australia.

13. Joël Houdet, Helen Ding, Fabien Quétier, Prue Addison, Pravir Deshmukh, 2020. Adapting double-entry bookkeeping to renewable natural capital: An application to corporate net biodiversity impact accounting and disclosure, Ecosystem Services, Volume 45, 101104, ISSN 2212-0416, https://doi.org/10.1016/j.ecoser.2020.101104.

14. I.e., ecosystem extent and condition, population / habitat size of individual species or functional groups.

15. URL: https://www.nbbnbdp.org/bd-protocol.html

Box 2: Reminder / The equations for the Statements of Biodiversity Position and Performance[16] that help present the Total, Positive and Negative Biodiversity Footprints of organisations

Equation of the Statement of Biodiversity Position (or Biodiversity Balance Sheet)

Biodiversity assets (ecosystem extent accounts in hectares) (A) = Cumulative positive impacts (condition-adjusted ecosystem extent accounts in hectares equivalent) (B) + Cumulative negative impacts (condition-adjusted ecosystem extent accounts in hectares equivalent) (C) or A= B+ C

Equation of the Statement of Biodiversity Performance (Biodiversity Net Impact Statement):

Net biodiversity impacts (hectares equivalent) (X) = periodic Positive Impacts/ Gains (condition-adjusted ecosystem extent accounts in hectares equivalent) (Y) – periodic Negative Impacts/ Losses (condition-adjusted ecosystem extent accounts in hectares equivalent) (Z) or X=Y-Z

16.URL: https://www.nbbnbdp.org/bd-protocol.html

2. A DEBK FRAMEWORK FOR PERIODIC AND CUMULATIVE GHG EMISSIONS & REMOVALS

2.1 GHG DEBK CONVENTIONS

In this section, we propose new conventions to DEBK to account for organisational GHG emissions and removals. We focus the analysis on three core components of GHG DEBK. More comprehensive guidance, aligned with existing GHG accounting and disclosure frameworks, would be required to help companies put together emissions inventories as per DEBK principles.

First convention

GHG DEBK involves developing equations for the Statement of GHG Position and the Statement of GHG Performance.

1- Equation of the Statement of GHG Position (GHG Balance Sheet) (net outcomes of all reporting periods): Cumulative GHG Removals (A) = Cumulative GHG Contributions (B) + Cumulative GHG Emissions (C).[17]

When the B account shows a negative amount, it is equivalent to the cumulative GHG debt of the organisation. When it shows a positive amount, then the B account presents the net positive cumulative climate contribution of the organisation to society. Tracking changes in these accounts is particularly important for long-term SBTs. It helps to demonstrate whether actual overall emissions reduction or convergence intensity are aligned with net-zero at the sector or global level.

2- Equation of the Statement of GHG Performance (GHG Profit / Loss Statement) (applies to a reporting period): Net Periodic GHG Contributions (X) = Periodic GHG Removals (Y) – Periodic GHG Emissions (Z)

When the X account is equal to zero, it shows the organisation has achieved net-zero emissions for the period (in line with the SBTi Corporate Net-Zero Standard). When it presents a negative balance, this means that the organization has a net periodic GHG emission. Conversely, when the X account indicates a positive balance, then this indicates that there has been a net periodic GHG removal. Tracking trends in net periodic GHG emissions should help an organisation understand whether it is meeting its SBTs on a periodic basis (i.e. a decrease in periodic GHG emissions from one year to another shows the amount of GHG emission reductions an organisation has effectively achieved for the period). This is particularly important for near-term SBTs.

17. To facilitate understanding, the equation can be re-written as Cumulative GHG Contributions (B) = Cumulative GHG Removals (A) - Cumulative GHG Emissions (C).

Furthermore, by convention:

- The (A) account increases when debited and decreases when credited;
- The (B) account increases when credited and decreases when debited;
- The (C) account increases when credited and decreases when debited;
- The (X) account increases when debited and decreases when credited;
- The (Y) account increases when credited and decreases when debited;
- The (Z) account increases when debited and decreases when credited.

Concerning fossil fuel deposits, these cannot de accounted for as removals or cumulative removals (i.e. not exploiting them would constitute avoided emissions). It would be counter-productive to the generally accepted goal of phasing them out, since holding fossil fuel stocks could help increase an organisation's positive GHG contribution if treated as removals.

Second convention

As is usual practice in organisational GHG footprint assessments (See GHG Protocol[18]), GHG emission inventories need to be segregated. Different gases have different global warming potentials (GWP) and lifetimes (Table 1). This means that different gases "behave" differently and can be "removed" by different processes. While CO_2 can be absorbed by biomass growth, CF_4 cannot. This calls for the separation of GHG accounts per GHG type. This is further supported by the fact that different GHG removal strategies have different lifetimes, and few may be considered as permanent[19].

Greenhouse Gas	Lifetime (Years)	100-Year GWP
Carbon Dioxide (CO_2)	hundreds	1
Methane (CH_4)	12	25
Nitrous Oxide (N_2O)	114	298
Hydrofluorocarbon-23 (CHF_3)	264	14 800
Sulphur hexafluoride (SF_6)	3 200	22 800
PFC-14 (CF_4)	50 000	7 390

Table 1: Lifetime and Global warming Potential for six key GHG; Source: Table 2.14 in the IPCC AR4 WG-I Report. Original table lists many more gases.

18.URL: https://ghgprotocol.org/corporate-standard

19.See Microsoft's experience in carbon removal strategies, URL: https://www.nature.com/articles/d41586-021-02606-3. Apparently, systems for accounting for carbon removal do not distinguish between short- and long-term forms of CO_2 storage.

Third convention

There are only six main types of accounting journal entries required to account for GHG emissions and removals (NB: separate entries for each GHG type should be done).

- Opening journal entry:
  - Debit (DR) Cumulative GHG Removals (A) account;
  - Credit (CR) Cumulative GHG Contributions (B) account;
  - CR Cumulative GHG Emissions (C) account.
- Periodic GHG emissions from operations (scopes, 1, 2 and 3):
  - DR Periodic Organisational GHG Emissions (Z) account;
  - CR Cumulative Organisational GHG Emissions (C) account.
- Periodic GHG removals from various processes (e.g., carbon credit purchase, net biomass growth on land owned, etc.):
  - DR Cumulative Organisational GHG Removals (A) account;
  - CR Periodic Organisational GHG Removals (Y) account.
- End of life of GHG (e.g., N years after initial emission date):
  - DR Cumulative Organisational GHG Emissions (C) account;
  - CR Periodic Organisational GHG Removals (Y) account.
- Sale of GHG credits:
  - DR Periodic Organisational GHG Removals (Y) account;
  - CR Cumulative Organisational GHG Removals (A) account.
- Closing the Statement of GHG Performance (at end of period):
  - DR / CR Net Organisational GHG Flows (X) account;
  - CR / DR Net Cumulative GHG Contributions (B) account.

NB: GHG emission reductions are not explicitly accounted for because they involve GHG that have not been emitted. Tracking differences (decrease / increase) in periodic GHG emissions, per GHG type, would help the organisation monitor the reduction amounts achieved (or not) over a given period.

2.2 GHG DEBK CASE STUDIES

Let's apply the proposed DEBK conventions for GHG accounting to two theoretical case studies, a newly created forestry company and a manufacturing business. For simplicity, GHGs are not distinguished, and only two reporting periods are used.

Tables 2 and 3 show the main GHG events taking place for these companies over two years[20]. Tables 4 and 5 presents the corresponding accounting journal entries while Table 6 shows the Statements of GHG Performance and Table 7 the Statements of GHG Position over these two years.

	Events	GHG Tons eq. CO_2	GHG outcome
Forestry company	Creation of company	15 000	Standing biomass stock
	Operations	1 500	Periodic emissions
	Tree growth	500	Periodic removals
Manufacturing company	Creation of company	150	GHG stored in physical assets
	Operations	12 000	Periodic emissions
	Goods stored prior to sale	1 500	Periodic removals
	Offset	1 200	Periodic removals

Table 2: GHG events for the forestry and manufacturing companies in year 1.

For year 1, the forestry business had negative periodic GHG contributions since it emitted more than it removed (X account = - 1 000 of Tons of CO_2 eq.; Table 6). Yet, its high Cumulative GHG Removals (biomass standing stocks[21] of 15 500 of CO_2 eq.) enabled it to retain positive Cumulative GHG Contributions (14 000 Tons of CO_2 eq.; Table 7). In year 2, despite increases in Periodic GHG Emissions, greater Periodic GHG Removals enabled the forestry company to generate small positive increases in both Periodic (200 Tons of CO_2 eq.; Table 6) and Cumulative GHG Contributions (14 200 Tons of CO_2 eq.; Table 7).

20. We assume that goods produce by the manufacturing companies have GHG stored within them (e.g., wooden components), which will be released over time during their use and eventual decay.

21. NB: removals due to biomass growth is a net balance figure considering GHG released by biomass decay during the same period.

	Events	GHG Tons eq. CO_2	GHG outcome
Forestry company	Operations	1 600	Periodic emissions
	Tree growth	1 800	Periodic removals
Manufacturing company	Operations	11 500	Periodic emissions
	Goods stored prior to sale	900	Periodic removals
	Offset	1 350	Periodic removals

Table 3: GHG events for the forestry and manufacturing companies in year 2.

The manufacturing company had a much more negative climate balance. In years 1 and 2, its important Periodic GHG Emissions (12 000 Tons of CO_2 eq. in year 1, 11 500 Tons of CO_2 eq.; Table 6) overshadowed its Periodic GHG Removals (including sustained investments in GHG offsets; Table 6). These negative Periodic GHG Contributions lead to a significant negative Cumulative GHG Contributions by the end of year 2 (- 18 400 Tons of CO_2 eq.; Table 7).

Forestry company	Account type	DR	CR
Opening journal entry			
Cumulative GHG Removals	A	15 000	
Cumulative GHG Contribution	B		15 000
Operations			
Periodic GHG Emissions	Z	1 500	
Cumulative GHG Emissions	C		1 500
Tree growth (net balance)			
Cumulative GHG Removals	A	500	
Periodic GHG Removals	Y		500
Closing statement			
Cumulative GHG Contribution	B	1 000	
Net Periodic GHG Contribution	X		1 000

Table 4: GHG accounting journal entries for forestry and manufacturing companies in year 1. **Part 1**

Manufacturing company	Account type	DR	CR
Opening journal entry			
Cumulative GHG Removals	A	150	
Cumulative GHG Contribution	B		150
Operations			
Periodic GHG Emissions	Z	12 000	
Cumulative GHG Emissions	C		12 000
Good stored prior to sale			
Cumulative GHG Removals	A	1 500	
Periodic GHG Removals	Y		1 500
Offsets			
Cumulative GHG Removals	A	1 200	
Periodic GHG Removals	Y		1 200
Closing statement			
Cumulative GHG Contribution	B	9 300	
Net Periodic GHG Contribution	X		9 300

Table 4: GHG accounting journal entries for forestry and manufacturing companies in year 1. **Part 2**

Forestry company	Account type	DR	CR
Opening journal entry			
Cumulative GHG Removals	A	15 500	
Cumulative GHG Contribution	B		14 000
Cumulative GHG Emissions	C		1 500
Operations			
Periodic GHG Emissions	Z	1 600	
Cumulative GHG Emissions	C		1 600
Tree growth (net balance)			
Cumulative GHG Removals	A	1 800	
Periodic GHG Removals	Y		1 800
Closing statement			
Net Periodic GHG Contribution	X	200	
Cumulative GHG Contributions	B		200

Table 5: GHG accounting journal entries for forestry and manufacturing companies in year 2. **Part 1**

Manufacturing company	Account type	DR	CR
Opening journal entry			
Cumulative GHG Removals	A	2 850	
Cumulative GHG Contribution	B	9 150	
Cumulative GHG Emissions	C		12 000
Operations			
Periodic GHG Emissions	Z	11 500	
Cumulative GHG Emissions	C		11 500
Good stored prior to sale			
Cumulative GHG Removals	A	900	
Periodic GHG Removals	Y		900
Offsets			
Cumulative GHG Removals	A	1 350	
Periodic GHG Removals	Y		1 350
Closing statement			
Cumulative GHG Contribution	B	9 250	
Net Periodic GHG Contribution	X		9 250

Table 5: GHG accounting journal entries for forestry and manufacturing companies in year 2. **Part 2**

Statement of GHG Performance **Forestry company**	**Account Type**	**Baseline**	**Year 1**	**Year 2**
Periodic GHG Removals	Y	15 000	500	1 800
Periodic GHG Emissions	Z	0	1 500	1 600
Net Periodic GHG Contributions	X=Y-Z	15 000	-1 000	200

Statement of GHG Performance **Manufacturing company**	**Account Type**	**Baseline**	**Year 1**	**Year 2**
Periodic GHG Removals (Good Stored Prior to Sale)	Y	150	1 500	900
Periodic GHG Removals (Offsets)	Y	0	1 200	1 350
Periodic GHG Emissions	Z	0	12 000	11 500
Net Periodic GHG Contributions	X=Y-Z	150	-9 300	-9 250

Table 6: The Statement of GHG Performance for the forestry and manufacturing companies over the two-year period. Negative Net Periodic Contributions (X) show periodic additions to the company's GHG debt while Positive Net Periodic Contributions (X) express periodic reductions in the company's GHG debt.

Statement of GHG Position **Forestry company**	**Account Type**	**Baseline**	**Year 1**	**Year 2**
Cumulative GHG Removals	A	15 000	15 500	17 300
Cumulative GHG Emissions	C	0	1 500	3 100
Cumulative GHG Contributions	B=A-C	15 000	14 000	14 200

Statement of GHG Position **Manufacturing company**	**Account Type**	**Baseline**	**Year 1**	**Year 2**
Cumulative GHG Removals	A	150	2 850	5 100
Cumulative GHG Emissions	C	0	12 000	23 500
Cumulative GHG Contributions	B=A-C	150	-9 150	-18 400

Table 7: The Statement of GHG Position for the forestry and manufacturing companies over the two-year period (Cumulative GHG Removals = Cumulative GHG Contribution + Cumulative GHG Emissions), with numbers highlighted in red showing the GHG debt and those in green, real positive GHG Contributions.

2.3 APPLYING GHG DEBK TO ACTUAL GHG DISCLOSURES

To illustrate this GHG DEBK framework with real data, let's look at UNILEVER GHG emission disclosures from 2018 to 2020[22]. Currently, only periodic GHG emissions are disclosed on an annual basis (top 3 lines of Table 8).

		2020	2019	2018
Periodic GHG Emissions	Scope 1 (tonnes CO_2 eq.)	606 771	659 028	1 652 057
	Scope 2 (tonnes CO_2 eq.)	171 906	443 897	893 825
	Scope 3 (tonnes CO_2 eq.)	60 388 592	61 020 357	62 017 585
Periodic GHG emission reductions	Scope 1 (tonnes CO_2 eq.)	52 257	993 029	N/A
	Scope 2 (tonnes CO_2 eq.)	271 991	449 928	N/A
	Scope 3 (tonnes CO_2 eq.)	631 765	997 228	N/A
Cumulative GHG Emissions	Scope 1 (tonnes CO_2 eq.)	2 917 856	2 311 085	1 652 057
	Scope 2 (tonnes CO_2 eq.)	1 509 628	1 337 722	893 825
	Scope 3 (tonnes CO_2 eq.)	183 426 534	123 037 942	62 017 585
Cumulative GHG Contributions	Scope 1 (tonnes CO_2 eq.)	-2 917 856	-2 311 085	-1 652 057
	Scope 2 (tonnes CO_2 eq.)	-1 509 628	-1 337 722	-893 825
	Scope 3 (tonnes CO_2 eq.)	-183 426 534	-123 037 942	-62 017 585

Table 8: UNILEVER GHG emissions from 2018 to 2020 expressed in Periodic GHG Emissions (Z account), periodic GHG emission reductions, Cumulative GHG Emissions (C account) and Cumulative GHG Contributions (B account). Only Periodic GHG Emissions are currently disclosed by the company.

22.See page 56 of the Unilever Annual Report and Accounts 2020 - URL: https://www.unilever.com/Images/annual-report-and-accounts-2020_tcm244-559824_en.pdf, as at November 3, 2021.

If we apply the GHG DEBK framework, UNILEVER's GHG emission disclosures for Scope 1, 2 and 3 can be expressed as Periodic GHG Emissions (Z account) for each year, with most of GHG emissions taking place within scope 3. For instance, there were 659 028 tons of CO_2 eq. emissions for Scope 1 in 2019. This changed to 606 771 tons of CO_2 eq. emissions in 2020 (Table 8).

Furthermore, the decreases in Periodic GHG Emissions from one year to another show the scale of GHG emission reductions achieved by UNILEVER. For example, GHG emissions were reduced by 449 928 tons of CO_2 eq. for scope 1 in 2019 (compared to 2018), but only by 52 257 tons of CO_2 eq. for the same scope in 2020 (compared to 2019) (Table 8).

If we further apply the GHG DEBK framework to these disclosures (Table 8), then:

- Cumulative GHG Emissions (C account) at the end of year 2020 (e.g., 183 426 534 tons of CO_2 eq. for Scope 3) equal the sum of the Periodic GHG Emissions for 2020 (60 388 592 tons of CO_2 eq. for Scope 3), 2019 (61 020 357 tons of CO_2 eq. for Scope 3) and 2018 (62 017 585 tons of CO_2 eq. for Scope 3);

- Cumulative GHG Contributions (B account) are equal to the Cumulative GHG Removals[23] (A account) (assumed to be zero, as per the same data source from UNILEVER[24]) minus Cumulative GHG Emissions (C account). In this case, the result of this equation is a negative number, highlighting UNILEBER's growing climate debt.

In other words, despite significant, absolute (yet decreasing rates of) reductions in GHG emissions for scopes 1, 2 and 3 from 2018 to 2020, UNILEVER would need to do much more to reduce its scope 3 emissions would it want to strive towards 1.5°C pathways and eventually address its climate debt.

Box 2: Climate and biodiversity nexus

Concerns should be raised over GHG emission removals strategies based on land use change (e.g., agrofuels / biofuels, tree plantations, especially using exotic species) and resource-intensive technologies (e.g., metal hungry energy systems requiring mining activity expansion, including in marine ecosystems). These would lead to further biodiversity and nature loss[25]. Accordingly, GHG Net-Zero targets should be aligned with ambitious biodiversity conservation, sustainable use and recovery targets (e.g., 30% positive biodiversity footprints[26], contribution to 30X30 protected area targets, Post 2020 Biodiversity Framework[27]). This implies ecosystem and landscape-based approaches to climate mitigation and adaptation investments.

23. UNILEVER could engage (and probably already are engaging) in various removal activities. For instance, aagricultural systems may store carbon to varying degrees, for instance in soils, depending on the farming practices put in place (e.g., tea farming in China – URL: https://www.fao.org/3/cb4580en/cb4580en.pdf).

24. Due to the lack of removals, Cumulative GHG Contributions (B account) are equal to Cumulative GHG Emissions (C account) for these GHG disclosures.

25. See IPBES assessments – URL: https://ipbes.net/

26. See BD Protocol. URL: https://www.nbbnbdp.org/bd-protocol.html

27. URL: https://www.cbd.int/conferences/post2020/post2020-prep-01/documents

3. CONCLUDING REMARKS

This paper shows how adopting new rules to DEBK enables accounting for the periodic and cumulative GHG emissions and removals of organisations, notably by helping produce Statements of GHG Performance and Position. DEBK based GHG accounting and disclosures are likely to improve climate-related risk management for reporting organisations, their investors and value chain partners. By reducing the likelihood of errors and frauds, GHG DEBK would help ensure greater transparency and accountability over the years (i.e. stronger audit trails) and should be used to enhance existing GHG accounting and disclosure frameworks.

Nevertheless, one should not overlook the various costs of transitioning (e.g., capacity building / training, information systems) to such an accounting system, including for both GHG practitioners and reporting organisations. These should be weighed against those of GHG emission underreporting[28] and the associated greenwashing practices, notably in relation to climate pledges such as net-zero targets.

Moreover, since it does not require the use of financial or monetary values, the proposed GHG DEBK framework brings credence to the thesis that robust, quantitative organisational natural capital accounting can emerge, for instance from an integrated reporting perspective. It focuses efforts on the design of new value articulation methods that can express the priceless worth of environmental phenomena (Farrell 2007)[29] and lead to integrated statements of position and performance using different value-framing metrics (Houdet *et al.*, 2014)[30].

28. For instance, companies in the digital technology industry are significantly underreporting the greenhouse gas emissions arising along the value chain of their products – URL : https://www.sciencedaily.com/releases/2021/11/211118203514.htm

29. Farrell, K.N., 2007. Living with Living Systems: the co-evolution of values and valuation. Int. J. Sustainable Dev. World Ecol. 14 (1), 14–26.

30. Houdet, J., Burritt, R., Farrell, K.N., Martin-Ortega, J., Ramin, K., Spurgeon, J., Atkins, J., Steuerman, D., Jones, M., Maleganos, J., Ding, H., Ochieng, C., Naicker, K., Chikozho, C., Finisdore, J., Sukhdev, P., 2014. What natural capital disclosure for integrated reporting? Designing & modelling an Integrated Financial – Natural Capital Accounting and Reporting Framework. Synergiz – ACTS, Working Paper 2014-01, 62 p.