Achieving net zero through value chain mitigation interventions

Exploring accounting, monitoring & assurance in food and agriculture

ValueChange

Achieving net zero through value chain mitigation interventions

Exploring accounting, monitoring and assurance in food and agriculture

Table of contents

About the authors

- → **Silvana Paniagua Tufinio** is Director of VCI Content Development at SustainCERT
- → **Pierre Bloch** is Head of Advisory and Innovation at SustainCERT
- → **Kai Streicher** is Director of LCA and Data Science at SustainCERT

The authors thank Francesca Palamidessi and Thomas Blackburn for their contributions. The authors are grateful to additional SustainCERT climate experts, Rodrigo Castro, Abigail Snyder, Stephen Benians, Gustave Coste, Guillaume Boinnard, Dario Vidaurre, Eva Boureghda, Simon Bolis, Larissa Ruckl, and Benjamin Bartley for their reviews, technical guidance, and advice.

Technical reviewers & acknowledgements

This document represents the output of the Value Change Initiative's Food and Agriculture Working Group, which conducted activities throughout 2022. The Value Change Initiative gratefully acknowledges the inputs and contributions provided during the Food and Agriculture Working Group sessions, and the technical reviews received towards the development of this document or previous versions, on specific parts, concepts, or the text in its entirety – recognising that their participation or contribution does not imply specific endorsement by individuals or organisations:

- → World Resources Institute - Matt Ramlow
- → Gold Standard - Owen Hewlett, Sarah Leugers
- → Quantis - Alexi Ernstoff, Jean-André Bonnardel
- → ISEAL Alliance - Kristin Komives, David D'Hollander
- → VERRA - Jonathon Alcock, Candace Vinke
- → Independent Consultant - Javier Castro

Partners and acknowledgements

The Value Change Initiative gratefully acknowledges the inputs, ideas, and experiences shared during the Food and Agriculture Working Group sessions and surveys, collected to support the development of this document or previous versions. The authors would like to acknowledge all the participants of the Food and Agriculture Working Group, their respective technical partners, and observing organisations for their feedback and perspectives, recognising that participation or contribution does not imply specific endorsement by individuals or organisations:

- → ACT Commodities - Connor Mckenzie, Alexandra Coulombe
- → BASF - Andrew Beadle, Tzutzuy Ramirez-Hernandez, Wojtek Kulczycki
- → Bayer - Adam Blight, Arlene Cotie, Monica McBride, Renata Ferreira, Rupinder Sandhu
- → Boortmalt - Inge De Winne, Peter Willaert, Rodrigo Vilches, Tom Bryan
- → CIBO Technologies - Nilovna Chatterjee, Nitzan Haklai, Steven Lemeshow
- → Danone - Christopher Adamo, Marie-Pierre Bousquet, Ryan Smith
- → Diageo - Vanessa Maire
- → ESMC - Debbie Reed, Nicole Capizzi
- → Farmers Edge - Jessica Bochek, Kim Klassen, Doug Cornell
- → Field to Market - Coralie Pierre
- → Friesland Campina - Aurelie LeTortu, Cezar Braga Alves
- → General Mills - Faith Perry, Steven Rosenzweig
- → Indigo AG - Alice Chang, Max DuBuisson, Ryan Jones
- → Interfood - Kevin Duisters, Stéphane Snepvangers , Xiaoyun Bing
- → Land O Lakes - Adrian Robinson
- → McDonald's - Peter Garbutt, Sara Kroopf
- → Neutral - Ann Radil, Lauren Brown
- → Nutrien - Michelle Nutting, Michael Gill
- → PepsiCO - Kristen Banks, Noora Singh, Thuy Phung
- → Rabobank - Lotte van Laarhoven
- → Regrow AG - Jeff Seale
- → Science Based Targets - Alberto Carrillo
- → Starbucks - Heather Pfahl, KT Michaelson, Nichole Embertson, Una Hrnjak
- → Syngenta - Liz Hunt, Steven Wall
- → Yara International / Agoro Carbon Alliance - Amber Foster, Samuel Aloni, Yuriy Lozynskyy
- → Viresco Solutions - Karen Haugen Kozyra (Technical Partner)
- → Quantis - Chris Casolaro (Technical Partner)
- → TerraCarbon - Dan Kane (Technical Partner)
- → Environmental Defense Fund - Simone Schenkel (Observing Organisation)
- → Nature United - Jane Church, Lisa Ashton (Observing Organisation)
- → The Nature Conservancy - Hannah Birge, Stephen Wood (Observing Organisation)

We also would like to acknowledge SustainCERT colleagues for their support in the development and production of this document, including editing, proof-reading and graphic design: Dino De Francesco and Laura Johnson. We also wish to acknowledge our VCI members and Corporate Advisory Group partners for their support and the core funding that they provide to the Value Change Initiative.

Executive summary

Conscious of the role they can play in global decarbonisation efforts, an increasing number of food and agricultural companies are setting science-based targets and making commitments to reduce their Scope 3 emissions. This inspiring momentum is swiftly followed by the bigger question: how can we move from commitments to credibly accounting, reporting, and claiming value chain emissions reductions and removals?

Introduced as an addendum to the *Value Change Intervention Guidance 1.1* (May 2021), this document is an in-depth technical extension which aims to provide food and agricultural companies with operational, sector-specific solutions to account for an Intervention, report impact up and down their value chains, and show progress towards their climate commitments or science-based targets. It builds on Part 1 - How To Account For An Intervention and Part 2 - How To Include An Intervention In The Scope 3 Inventory of the Guidance by providing an updated definition of Supply Shed, a list of criteria for "credible" Supply Sheds, and safeguards around Intervention accounting. It also proposes a methodology to improve inventory data using LCA frameworks, new potential assurance principles for a market-based approach, and expands on the meaning of investing in "collective action".

This addendum to the Value Change Intervention Guidance 1.1 is an outcome of the 2022 Value Change Initiative Food and Agriculture Working Group. It is the result of a shared learning and co-creation process between 31 organisations committed to solving practical challenges and paving the way for meaningful Scope 3 action. Striving for convergence in GHG accounting practices in the sector was critical to the process and this addendum aims to align with relevant guidance documents, such as the Science Based Targets Initiative's FLAG Guidance, including those in development or review, such as the GHG Protocol's Land Sector Removals Guidance and ISO 14068 Greenhouse gas management and climate change management and related activities — Carbon neutrality.

1.
Updated Supply Shed definition and criteria for “credible” Supply Sheds

“Supply Shed” is a concept and approach that can enable credible accounting and reporting of value chain interventions in situations where sourcing strategies are dynamic, and traceability or sustainability data is “imperfect”. A supply Shed serves two key purposes: (1) incentivising investments for traceability by allowing the claim of mitigation outcomes generated in a Supply Shed (market-based allocation or accounting); and (2) enabling credible co-claiming and co-investment by allowing multiple parties to execute interventions in a region where they source but may not directly influence their exact suppliers (market-based attribution).

This addendum outlines principles for a credible Supply Shed – it needs to be actionable, auditable, measurable and a catalyser for climate action – as well as criteria to define an auditable Supply Shed and guide implementation. These criteria include: (1) good/service equivalence as per ISO 14040 or applicable product category frameworks; (2) definition by a region/jurisdiction linked to a Chain of Custody checkpoint where an audit can be conducted; and (3) providing backbone support for inventory efforts, including a sampling exercise and quantification approach. Supply Shed and the criteria in this addendum have been defined to converge with the “sourcing region” approach presented in the *Land Sector and Removals Guidance* (Chapter 8).

2.
Safeguards around Intervention accounting

Credible GHG accounting requires high quality data. In the context of “imperfect” and limited availability of data, the question for most organisations when it comes to measuring and accounting mitigation outcomes quickly becomes: what “good” is “good enough”? This addendum explores various solutions, including from the LCA domain, and proposes a framework to assess uncertainty in datasets used for GHG modelling. The approach proposed by the authors intends to make the best use of existing data and incentivises the collection of high-quality primary data where and when it matters. In practical terms, this means a dedicated quantitative approach is required to assess the uncertainty relative to the parts of the emissions factor (EF) that is impacted by the intervention. For the rest of the EF, a quantitative approach is preferrable but other solutions exist.

3.
Methodology to improve inventory data using LCA frameworks

Additional methods to prepare for improving data efforts, such as interfacing, are also discussed in this addendum. Interfacing refers to the approach of combining inventory accounting methods with Intervention or project accounting techniques which are widely adopted in the Voluntary Carbon Markets and LCA-sphere. The authors advocate that Interfacing default LCA-based data with Intervention data can bring consistency in the calculations and increase Intervention data quality. They also highlight the advantages of conducting process substitution (i.e., substituting data for both the emission factor (EF) and for the demand of the different inputs), which helps identify the best opportunities for reduction and removal in the value chain. Interfacing should be considered to improve inventory accounting, to support learning from Interventions, to make strategic decisions, and to manage risks in the supply chain and operations

4.
Assurance principles for market-based approach

Assurance, in particular third-party assurance, is critical for the credibility of claims, yet current guidance for organisational GHG accounting offers limited information on the levels of assurance that should be provided by practitioners.

There are multiple ways to build up assurance in a system, yet only a few can deliver trust and impact at scale. This addendum proposes five potential principles for developing an assurance system that is feasible, scalable, and cost effective: impartiality; flexiblility; user-centric; standardised; actionable and improvement-oriented; and progressive.

5.
Investing in and supporting “collective action”

To truly drive a holistic and sustainable climate strategy, companies need to collaborate with peers and other stakeholders. This is possible through organised collective action. Collective action is key to: (1) develop and align different organisations around a common vision; (2) enable effective use of resources as a result of coordinated actions; and (3) achieve or maintain consistent progress in a sector by creating a common framework for accountability and advocating for transparency and disclosure.

The Supply Shed approach could be key to fostering collective action and supporting joint implementation, action coordination, and pooling of resources on activities such as MRV, assurance, or enabling interventions. For the authors, companies working on climate action must balance both individual and collective action. And while enabling interventions might not lead to an attributable claim, these efforts are a way for companies to take responsibility for emissions and are necessary for improving the likelihood of a successful outcome.

Enabling value chain interventions at scale requires financing. This addendum also highlights the various possible financial mechanisms to support interventions and the consequential claims that can be made. The authors argue that the Supply Shed approach has the potential to de-risk financial mechanisms and support accounting and disclosure efforts. Companies in a value chain that have an active interest in claiming reductions from Supply Sheds will have diverse opportunities to tap into finance provided that causality is established and safeguarded in Interventions, and that registries are in place to ensure proper tracking of claims.

Glossary

The terms and definitions applied in this addendum generally refer to and align with the Greenhouse Gas Protocol 'Corporate Value Chain (Scope 3) *Accounting & Reporting Standard* (henceforth "Scope 3 Standard"). In addition, reference is made to the Greenhouse Gas Protocol *Technical Guidance for Calculating Scope 3 Emissions* (henceforth "Scope 3 Technical Guidance") and the *GHG Protocol for Project Accounting* (henceforth "GHG Protocol's Project Protocol"). The following key terms are highlighted as adjusted and/or additional terms applied within this addendum. Some are also provided for ease of reference, marked as, for example, "from GHG Protocol Scope 3 Standard".

Readers should be aware that this document is being published prior to the release of the Greenhouse Gas Protocol's *Land Sector and Removals Guidance*. Furthermore, the Greenhouse Gas Protocol started a process to collect stakeholders input to understand the need, scope, and potential approaches to inform updates or additional guidance related to GHG Protocol's *Corporate Standard*, *Scope 2 Guidance*, *Scope 3 Standard*, and supporting documents. These updates are likely to include further clarifications and requirements concerning several key concepts outlined in this document. Therefore, the terms and definitions within this guidance may be subject to revision.

TERM	Definition
Abatement	[From SBTI Net Zero Standard] Measures that companies take to prevent, reduce, or eliminate sources of GHG emissions within their value chains. Examples include reducing energy use, switching to renewable energy, and retiring high-emitting assets.
Additionality	[Adapted from the Nordic Code for Voluntary Use of Carbon Credits] At the time of the decision to implement a mitigation activity, the outcomes of such an activity would not have occurred due to the absence of the incentives created by the carbon related revenues.
Allocation	[Adapted from GHG Protocol Scope 3 Standard] The process of assigning the GHG emissions profile of a system (e.g., production unit, quantity of goods) to the various outputs of the system based on physical or economic data specific to the studied system (including its socio-economic and geographical scales).
Assurance	[From GHG Protocol Scope 3 Standard] The level of confidence that the inventory and report are complete, accurate, consistent, transparent, relevant, and without material misstatements.
Attribution	The process of assigning a GHG emissions profile from a studied system (e.g., production unit, quantity of goods) amongst organisations based on certificates of GHG attributes, which enables the faster scaling of investment in impact through the use of market-based mechanisms. Note that the term may be used interchangeably with "assignment".
Audit trail	[Adapted from GHG Protocol Scope 3 Standard] Organised and transparent historical records documenting how the GHG inventory was compiled.
Baseline	[Adapted from GHG Protocol Scope 3 Standard] A hypothetical scenario for emissions that is predicted or assumed to occur in the absence of the incentives created by the carbon credits and their associated mitigation activities, while holding all other factors constant.

Beyond value chain mitigation (BVCM)	[From SBTI Net Zero Standard] Mitigation action or investments that fall outside a company's value chain. This includes activities that avoid or reduce greenhouse gas emissions, or that remove and store greenhouse gases from the atmosphere. Examples of BVCM include, but are not limited to: forestry, e.g., Jurisdictional REDD+; conservation projects, e.g., peatland or mangrove protection/regeneration; energy efficiency, e.g., cookstove projects; methane destruction, e.g., landfill gas projects; renewable energy, e.g., solar/wind/biogas; industrial gases, e.g., N2O destruction at nitric acid facilities; scale-up of CDR technologies, e.g., direct Air Capture (DAC) and storage.
Carbon credit	[From the Nordic Code for Voluntary Use of Carbon Credits] A carbon credit is a tradable financial instrument that is issued by a carbon crediting programme and that represents a verified GHG mitigation outcome of one metric tonne of carbon dioxide equivalent, calculated as the difference between the baseline and activity emissions. Carbon credits are uniquely serialised, issued, tracked, and retired or cancelled by means of an electronic carbon registry operated by an administrative body such as the administrator of a carbon crediting programme.
Carbon crediting programme	[From the Nordic Code for Voluntary Use of Carbon Credits] A carbon crediting programme is a standard-setting programme for registering mitigation activities and issuing carbon credits against the programme's criteria. High-Integrity Carbon Credits need to be issued by best in class carbon crediting programmes that meet such as ICVCM's CCPs.
Carbon dioxide	[From Intergovernmental Panel on Climate Change (IPCC)] A naturally occurring gas, CO2 is also a by-product of burning fossil fuels (such as oil, gas, and coal), of burning biomass, of land-use changes (LUC), and of industrial processes (e.g., cement production). It is the principal anthropogenic greenhouse gas (GHG) that affects the Earth's radiative balance. It is the reference gas against which other GHGs are measured and therefore has a global warming potential (GWP) of 1.
Carbon neutrality	[From the United Nations Framework Convention on Climate Change (UNFCC)] "Climate neutrality" refers to the idea of achieving Net Zero greenhouse gas emissions by balancing those emissions so they are equal to (or less than) the emissions that are removed through the planet's natural absorption; in basic terms it means reducing emissions through climate action. Carbon neutrality is also referred to as "Net Zero CO2 emissions".
Carbon registry	[From the Nordic Code for Voluntary Use of Carbon Credits] A database for tracking the issuance, transfers, and use of carbon credits.
Causality	[From VCI 1.1 Guidance] Causality is the demonstration that an investment (or other equivalent action) of a company or group of companies acting collectively is what caused the Intervention to happen. Causality does not guarantee rights to be able to issue or retire carbon credits for other purposes from an intervention. This depends on the requirements of the issuing body, which may not necessarily align directly with this definition. This definition was strengthened by the SBTi FLAG guidance and method addendum published in November 2022: "A company claiming to follow this guidance must show that they have contributed to the upkeep and continuation of the carbon farming Intervention. The company should ensure no double claiming of causality is done."
Chain of Custody (CoC)	[From ISEAL CoC Models and Definitions] The custodial sequence that occurs as ownership or control of the material supply is transferred from one custodian to another in the supply chain'. Documenting Chain of Custody describes the list of all organisations in the supply chain that take ownership or control of a product during production, processing, shipping and retail (physically and/or administratively).
Climate change mitigation	[From the Intergovernmental Panel on Climate Change (IPCC)] A human Intervention to reduce emissions or enhance the sinks of greenhouse gases.

Corporate climate targets [From SBTI Net Zero Standard] Goals set by a corporation to reduce the corporation's impact on the climate. Targets may include a variety of climate forcers across different corporate activities (i.e., operations, value chain, products) and may use emissions abatement or neutralisation.

Cradle-to-gate [Adapted from GHG Protocol Scope 3 Standard] Cradle-to-gate is a partial life cycle inventory, including all emissions and removals from material acquisition through to when the intermediate product leaves the reporting company's gate (typically immediately after production) and excluding final product use and end-of-life.

Decarbonisation [From SBTI Net Zero Standard] The process by which CO2 emissions associated with electricity, industry, and transport are reduced or eliminated.

Double claiming [From the Nordic Code for Voluntary Use of Carbon Credits] A situation in which the same mitigation outcome is claimed by more than one different actor (member of the same value chain or not), e.g., once by an organisation sourcing from a Supply Shed (the organisation reports lower emissions or higher removals for the purpose of demonstrating achievement of a mitigation target or goal), and once by an actor using a certificate from a low GHG certification scheme implemented in the same Supply Shed.

Double counting [From the Nordic Code for Voluntary Use of Carbon Credits] A situation in which a mitigation outcome is counted more than once. Double counting can occur through double issuance of impact units, double use and/or double claiming.

Double issuance [From the Nordic Code for Voluntary Use of Carbon Credits] A situation in which more than one impact unit is issued for the same mitigation outcome. This can occur when the same mitigation activity is registered under two different programmes or twice under the same programme.

Double use [From the Nordic Code for Voluntary Use of Carbon Credits] A situation in which the same mitigation outcome is counted more than once towards achieving climate change mitigation. This could, for example, occur if an actor used a single impact unit to fulfil two different purposes.

Economic allocation [From GHG Protocol Scope 3 Standard] Allocating the emissions of an activity based on the market value of each output/product. For example, input and output data might be allocated between co-products in proportion to the economic value of the products.

Emissions (or GHG) inventories [From SBTI Net Zero Standard] According to the GHG Protocol, a "quantified list of an organisation's GHG emissions and sources". Emissions inventories typically include emissions in Scopes 1, 2, and 3.

Emissions Factor (EF) A factor that converts activity data into GHG emissions data (e.g., kg CO2eq emitted per litre of fuel consumed, kg CO2eq emitted per kilometre travelled, etc.). Emission factors can be calculated for input processes. The emission factor of an input process represents the global warming potential of this process expressed in kg CO2eq. By extension, the emission factor of a product system link is the sum of the emission factors of the related input processes weighted by their demand for this product system link.

Environmental integrity [From SBTI Net Zero Standard] In the context of markets for mitigation outcomes, environmental integrity means that market-based cooperation must not lead to an increase in global net GHG emissions compared with the scenario where market-based instruments are not used.

Extrapolated data [From GHG Protocol Scope 3 Standard]: Data from a similar process or activity that is used as a stand-in for the given process or activity and has been customised to be more representative of the given process or activity.

Final product [From GHG Protocol Scope 3 Standard] Goods and services that are consumed by the end user in their current form, without further processing, transformation, or inclusion in another product. Final products include not only products consumed by end consumers, but also products consumed by businesses in the current form (e.g., capital goods) and products sold to retailers for resale to end consumers (e.g., consumer products).

First-party assurance [From GHG Protocol Scope 3 Standard] Person(s) from within the reporting company, but independent of the GHG inventory process, that conduct(s) internal assurance. (Also known as "self-" or "internal-assurance.")

Functional and Service Equivalence Functional and Service Equivalence refers to an equivalent type and level of activity of goods or services provided between the Intervention and the baseline scenario. Goods and services of similar enough type and equal quality that can deliver the same level of service and therefore serve the same market segment at a national or sub-national level.

GHG Protocol Guidance Corpus of standards published on the GHG Protocol website as of January 2023.

Impact layer An impact layer is a step in a good's value chain. It can be a production step, a transformation step, a transport, etc.

Impact Unit Absolute reduction/removal (in tonnes CO2e) that results from a delta between emission factors of the baseline and project scenario of an Intervention multiplied by the amount that has been impacted by the Intervention.

Interfacing Interfacing of ISO 14064-1 and ISO 14064-2 approaches for GHG inventory and modelling aims at maximising the intelligence derivable from available data. This is achieved though the inclusion of highly specific primary data into datasets composed mainly of secondary/inaccurate data. The primary data collection is used to assess the mitigation outcomes derived from an Intervention.

Intervention [From VCI 1.1 Guidance] An umbrella term for any action that introduces a change to a Scope 3 activity. This could include a new technology, practice, or supply change (for example, to a different product input or sourcing location) to reduce or remove emissions. An Intervention may include changes to several activities that reduce or sequester emissions in different ways and that may or may not be included within the Scope 3 Inventory. An Intervention can consist of one or several activities of the same or different type following the same validation and verification cycle.

Intervention accounting [From GHG Protocol LSRG draft] Intervention accounting (also known as project accounting methods) is an assessment of the GHG emissions of actions relative to counterfactual baseline scenarios (conditions most likely to occur in the absence of the action) or other performance standards.

Intervention baseline The business-as-usual scenario most likely to take place in the absence of the Intervention. The baseline should represent the immediate supply chain of the relevant goods or services, or within a reasonable timeframe (i.e., where data is available and where the situation can be accurately verified) of the implementation of the Intervention. The baseline should account for the condition as close to reality and as consistent with the accounting for the post-Intervention state as is feasible.

Intervention investor A stakeholder that has potential rights to claim for reporting within a Scope 3 boundary or issue carbon credits for sale to offset buyers.

Inventory accounting Inventory accounting is used to calculate and report annual GHG emissions from sources (and removals by sinks, if applicable) within the reporting entity's inventory boundary. GHG inventories reflect direct (Scope 1) and indirect emissions (Scope 2 and 3), where progress is tracked relative to a historic base year or period.

Insetting There are multiple definitions for the term "insetting" and no standardisations, which makes it difficult to give a clear determination of what can and can't be included within Scope 3 reductions.

Level of assurance The degree of confidence stakeholders can have over the information in the inventory report.

Limited level of assurance [From ISO 14064-3] In the context of verification of projects, a limited level of assurance means that the verification risk is higher than in the case of a reasonable level of assurance, that the nature, timing, and extent of evidence gathering activities is deliberately less than for a reasonable level of assurance but still results in assurance that is meaningful to intended users. This results in a negative opinion, e.g., "Based on the process and procedures conducted, there is *no evidence* that the GHG statement *is not* materially correct and *is not* a fair representation of GHG data and information."

MRV Effective mitigation of climate change requires a clear understanding of greenhouse gas emissions and their sources, and regular monitoring of mitigation strategies and their impacts. The practice of "MRV," integrates three independent-but-related processes of measurement or monitoring (M), reporting (R), and verification (V).

Mitigation outcome [From the Nordic Code for Voluntary Use of Carbon Credits] Emission reductions and removals are jointly referred to as mitigation outcomes.

Offsetting [From the Nordic Code for Voluntary Use of Carbon Credits] Offsetting refers to the voluntary use of High-Integrity Carbon Credits and the claiming of the associated mitigation outcome exclusively for counterbalancing an equivalent amount of GHG emissions attributed to an actor, product, or service within its boundary or value chain, such that the combined contribution of these High-Integrity Carbon Credits and emissions to global net GHG emissions is zero.

Removal (CDR) [From SBTI Net Zero Standard] Measures taken by companies to sequester CO2 within or outside the value chain in order to permanently remove it from the atmosphere and durably store it in geological, terrestrial, or ocean reservoirs, or in products. The removals are either nature-based, geological, or a hybrid.

Representativeness The principle of representativeness implies the variability in GHG models and reflects the degree of GHG data accuracy, that can be drawn about a population based on a sample. It provides the basis for a conservative approach in GHG accounting.

Stranded asset [From the Intergovernmental Panel on Climate Change (IPCC)] Stranded assets are "Assets exposed to devaluations or conversion to 'liabilities' because of unanticipated changes in their initially expected revenues due to innovations and/or evolutions of the business context, including changes in public regulations at the domestic and international levels."

Supply Shed [From VCI 1.1 Guidance] Supply Shed has been broadly defined as a group of suppliers in a specifically defined market (e.g., at a national or sub-national level) providing functionally equivalent goods or services (commodities) that can be demonstrated to be within the company's supply chain.

Theory of Change (ToC) The Theory of Change of an Intervention depicts the causal pathways from outputs through outcomes via intermediate states towards impact. A Theory of Change is a method that explains how a given Intervention, or set of Interventions, is expected to lead to a specific change in emissions due to anthropogenic activities, drawing on a causal analysis based on available evidence, respecting of the environmental integrity definition, with an adequate level of assurance.

Uncertainty In general, uncertainty relates to the imperfection in data inputs (from inventory accounting and modelling efforts) used to estimate emission levels. The GHG Protocol defines uncertainty as twofold: (1) Quantitative definition: Measurement that characterises the dispersion of values that could reasonably be attributed to a parameter. (2) Qualitative definition: A general and imprecise term that refers to the lack of certainty in data and methodology choices, such as the application of non-representative factors or methods, incomplete data on sources and sinks, lack of transparency etc.

Validation [From the Nordic Code for Voluntary Use of Carbon Credits] In the context of carbon crediting programmes, validation refers to an assessment by a competent third-party entity of a mitigation activity requesting registration, against relevant criteria under a carbon crediting programme.

Verification [From the Nordic Code for Voluntary Use of Carbon Credits] In the context of carbon crediting programmes, verification is the periodic independent review and ex-post determination by a competent third-party entity of the request to issue carbon credits against monitored mitigation outcomes generated by a mitigation activity during a specific monitoring period, in line with relevant criteria under a carbon crediting programme.

1

Introduction and context

The Value Change Initiative (VCI) published *Value Chain (Scope 3) Interventions - Greenhouse Gas, Accounting & Reporting Guidance Version 1.1*[1] ("VCI Guidance") in 2021. The Guidance aims to enable and incentivise climate change mitigation interventions ("Interventions") in corporate value chains by providing an approach to account for GHG mitigation outcomes against targets for Scope 3 category 1: Purchased Goods and Services, in line with leading standards. The VCI Guidance was leveraged by organisations including the Greenhouse Gas Protocol ("GHGP") and the Science Based Targets initiative ("SBTi") to develop thinking on the draft *Land Sector Removal Guidance* ("LSRG") from GHGP, market-based mechanisms, and the Chain of Custody (CoC) model. VCI Guidance is also influencing the development of methodological products for other GHGP categories.

This addendum to the VCI Guidance explores the accounting, monitoring, and assurance on Intervention mitigation outcomes at the level of the Supply Shed. At the time of writing, the VCI Working Group is aware that SBTi is forming a coordination group to define how Scope 3 Interventions may or may not be included towards science-based targets (SBTs). It is anticipated that the outcome of the coordination group will include processes and tools required for organisations to submit GHG inventories and Interventions reports, including supporting evidence required to assign the mitigation outcomes to an organisation. The VCI acknowledges that the content shaped in that document is being developed as a parallel effort and trusts that most of the material will be relevant for organisations currently building Net Zero GHG corporate strategies.

The VCI hosts sector-specific Working Groups to extend the VCI Guidance through addenda to answer key challenges surfaced by practitioners, project developers, and corporates and around Scope 1, 2, and 3 accounting. In the case of the Food and Agriculture Working Group, the key topics identified included data tracking, accounting of land-based emissions including biogenic removals and land-use change, monitoring and data management, reporting, and claiming Interventions. Throughout 2022, the Food and Agriculture Working Group met to formalise in detail the common challenges facing Forest, Land and Agriculture ("FLAG") value chains regarding GHG accounting and co-created practical solutions.

Building on the VCI Guidance, the Working Group decided to focus efforts on further developing guidance for specific challenges: answering accounting challenges for GHG reduction and/or removals at the level of operational units comprised in an Intervention area that require monitoring, reporting, and verification ('MRV') to achieve reasonable credibility. In addition to this, the Working Group focused efforts to develop guidance for solving the Chain of Custody challenges in a tracking system to attribute mitigation outcomes to goods and value chain members in the context of limited traceability.

A key aim of this process was to strive for convergence in GHG accounting practices in the sector. The Working Group discussions aimed to align with relevant guidance documents including those in development and/or review, namely SBTi's *Forest, Land, and Agriculture Science Based Target Setting Guidance*, the second draft of GHGP's *Land Sector Removal Guidance* (LSRG) and ISO/DIS 14068 *Carbon Neutrality*. In autumn 2022, the Working Group acted as Supporting Partner (pilot) in the development of the LSRG, to aggregate individual company feedback on integrating the LSRG into their climate change mitigation programmes and projects.

1 The VCI Guidance was developed in a process led by Gold Standard and the Value Change Initiative. The following organisations were involved in initiating, designing, and developing the Guidance: Climate KIC, CDP, Danone, Mars, Livelihoods Fund, WRI and WWF. URL: https://valuechangeinitiative.com/wp-content/uploads/sites/2/2021/10/11.Value-Change-Interventions-Guidance.pdf following discussions, inputs and critical feedback achieved through the Value Change Initiative's Workstreams.

In addition, the authors of this addendum closely followed and contributed to the development of ISEAL Alliance's *Guidance for Sustainability Systems to Design and Implement Credible Greenhouse Gas Reporting Systems*. The Working Group also closely monitored the evolution of thinking from ISEAL Alliance's *Making Credible Jurisdictional Claims – ISEAL Good Practice Guide Version 1.1*, ISO 14068 *Carbon Neutrality* (under development), and IWA 42 *Net-Zero Guiding Principles* to drive consistency and convergence.

The Group's discussions showed the critical importance of efforts for convergence crystallising around three main topics:

1. Working towards the establishment of a common ground for efficient benchmarking and harmonisation of environmental impact assessment methodologies for GHG accounting, including some solutions from Life Cycle Assessment (LCA) tools, as per ISO 14044 and Product Environmental Footprint Category Rules Guidance (PEFCR) definitions.
2. Aiming at a common set of requirements between carbon credits and dynamic GHG accounting to deliver Net Zero.
3. Anticipating upcoming requirements from major trailblazing government practices that will directly or indirectly affect the sector, for example, the EU Carbon Border Adjustment Mechanism.

The result of VCI's co-creation process led by the 2022 Food and Agriculture Working Group is contained in this addendum to the VCI Guidance.

2

Scope and applicability

The Food and Agriculture Addendum to the VCI Guidance focuses on key accounting and MRV issues, namely:

1. Supply Shed definition, criteria, and possible overlay with sourcing region definition
2. Safeguards and representativeness for Intervention accounting
3. Leveraging the track record of project accounting for inventory accounting
4. MRV for Interventions at the supply chain-level
5. Assurance implementation principles for market-based allocation

This addendum recognises the constraints of GHG accounting and reporting caused by "imperfect" traceability for physical goods and the limited data accessible or available on demand for GHG modelling. Many of the solutions described in this document require the prudent exploration of market-based allocation where perfect matching of physical flows and information flows is not achieved (and will not be achieved in a short time frame). These solutions also require the exploration of market-based attribution of mitigation outcomes as a starting point where value chain actors ready to invest in impact could be allowed to claim impact beyond the physical quantities procured in that Supply Shed and in coherence with the total amount of impact available in a given year in that Supply Shed. These mechanisms are likely to be conditioned to a payment that can be traced to establish causality between payment made by the buyer and the initial investment made by the Intervention developer.

Allocation in LCA spheres is largely performed with economic parameters (e.g., Exiobase EEIO database) — using economic data to allocate environmental impacts based on the economic value of goods. This differs from market-based attributions whereby a GHG attribute of a good would be based on a market mechanism that does not necessarily guarantee a physical link in the real world. In this addendum, solutions for accounting and required MRV developed specifically for GHG removals are noted where relevant or applicable.

This addendum does not intend to explicitly address specific chapters of the draft GHGP LSRG; however, much of the proposed guidance is relevant, in part, to Chapters 5, 6, 7, 8, 15, and 16 in relation to sourcing region safeguards. The authors trust that this addendum will be particularly relevant for practitioners, specifically for the implementation of Chapter 16 which focuses on the prioritisation for the collection of "primary data […] needed to demonstrate reduced emissions from the implementation of specific GHG reduction strategies or practices, which would not otherwise be captured through secondary data." As part of the Food and Agriculture Working Group's Supporting Partner role in the LSRG pilot, the Group's aggregate feedback will be shared separately with GHGP. Furthermore, cognisant that wider changes in the organisational landscape of GHG standards may follow, this document also aims to also inform relevant stakeholders that will drive guidance in Scope 3 target setting, accounting, and reporting.

Valuable insights were gained from ongoing pilot Interventions running simultaneously with the Working Group. These insights and case studies informed the addendum's content, where applicable. This addendum is specific to the Food and Agriculture sector and is intended for use by sustainability teams within global companies and key sectoral practitioners to support the thinking in the development of environmental strategies and for leading standards organisations to consider in revisions of standards and frameworks.

Multiple and diverse perspectives ultimately strengthen the recommendations provided here, and their general acceptance, and as such, the content of this addendum has been shared with the broader VCI consortium, including beyond the Working Group participants. In addition, the VCI is in dialogue with leading GHG accounting standards

to explore potential synergies and useful integrations of the accounting and MRV practices and identified solutions developed through this addendum.

This addendum is organised around the key accounting and MRV issues introduced above, it examines each issue, presents an outlook for the desired end state, and focuses on action-oriented recommendations for further implementation. It concludes with a future outlook and poses further questions for consideration.

3

Supply Shed definition, criteria, and possible overlay with sourcing region definition

This chapter aims to capture the characteristics that define a Supply Shed and provides potential criteria to guide implementation and documentation. The Supply Shed is defined by multiple dimensions, some of which are anticipated to be sector specific.This addendum focuses on important dimensions to be considered when defining a Supply Shed for FLAG sector companies. In particular, it is anticipated that critical characteristics of a Supply Shed will include operation units archetypes, functional equivalency for outputs, geography (including eco-region), and markets served (including Chain of Custody checkpoint).

Challenge identified:
Interventions in supply chains with “imperfect” traceability cannot be accounted under the current GHGP guidance. To solve this, the Supply Shed proposes a credible market-based approach. However, at the time of the writing, there are no specific requirements from a standard-setting body that define a Supply Shed.

Relevance:
Defining specific criteria for a credible Supply Shed is key to implementing the approach. Furthermore, these criteria must aim for convergence with the draft LSRG “sourcing region” definition that is currently under review as an open question for piloting.

3.1 Definition of a Supply Shed (updated)[2]

"Supply Shed" has been broadly defined as a group of suppliers in a specifically defined market (e.g., at a national or sub-national level) providing functionally equivalent goods or services (commodities) that can be demonstrated to be within the company's supply chain. This section aims to build upon previous definitions and sharpen the outlines of the concept.

The above approach is valuable in situations where a company may not be able to directly trace sourcing to a specific upstream supplier or producer (farm or land-management unit), but it is known (i.e., demonstrated and auditable) that sourcing comes from a group of suppliers within the Supply Shed from which the company sources.

Box 1. **Why is a Supply Shed approach needed?**

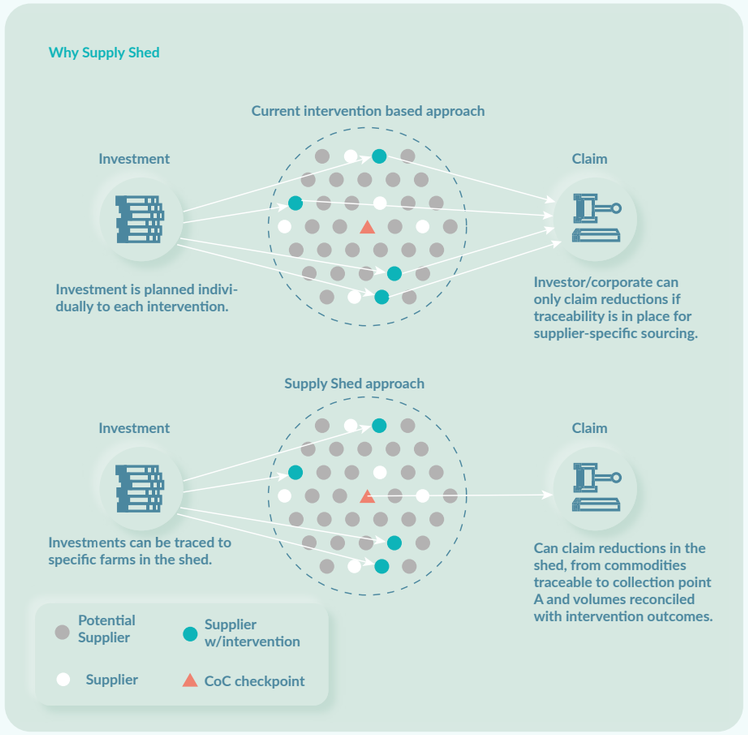

Figure 1. Without and with a Supply Shed approach

The Supply Shed is an accounting concept set in accordance with safeguards to enable credible GHG reporting in the context of "imperfect" traceability and sustainability data. Perfectly consistent long-term sourcing is not common practice, and therefore the Supply Shed approach allows for accounting while sourcing strategy is dynamic. The approach also aims to solve the challenge of impact and the Chain of Custody models, in contexts where the segregation of physical flows of goods may not be achievable (nor desirable in terms of GHGs) and where the perfect tracking of goods and mitigation outcomes is not achieved.

2 SustainCERT S.A. (2021). *SustainCERT Verification Requirements for Value Chain Interventions (Version 0.9).*Available upon request

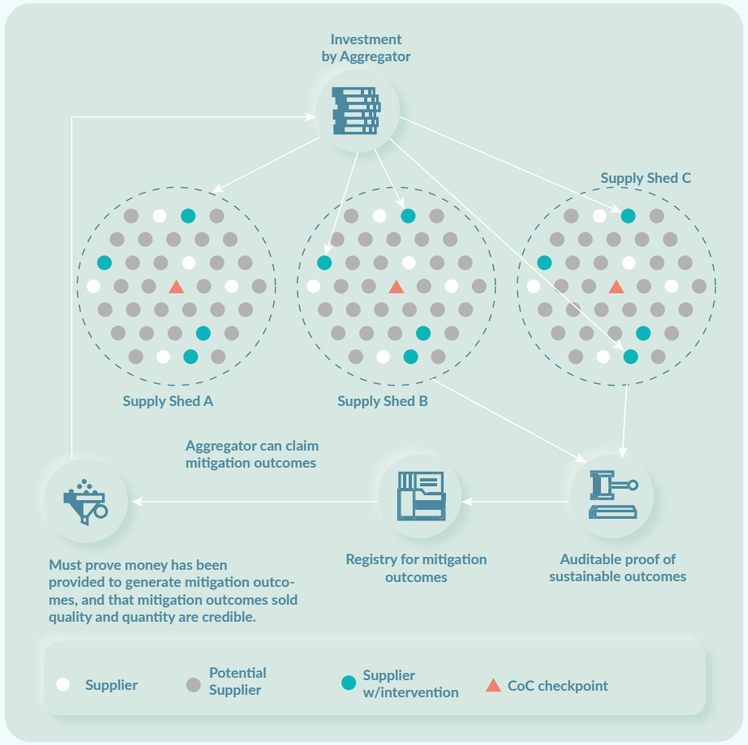

Figure 2. Investment in an Intervention

Interventions include various activities and can cover multiple Supply Sheds. Methodologies to include mitigation outcomes generated by these activities in inventories must alleviate potential barriers to investment, such as the "stranded environmental assets" challenge. For example, if an investment is made to deploy an Intervention in Supply Sheds A, B, and C, and Supply Shed A exits the Intervention after a few years, Supply Shed A does not deliver mitigation outcomes and reversal for removals must be accounted for. Supply Sheds B and C keep on delivering the mitigation outcomes, and investment initially planned for Supply Shed A can be shifted to these Supply Sheds. The investment for the Intervention, including on MRV, is therefore not lost as a simple deviation to the initial project design can be introduced to acknowledge the change.

The Supply Shed is compatible with the "sourcing region" approach presented in the draft LSRG (Chapter 8, including the Open Question #3), where it is defined as the region that serves a known first collection point or processing facility on a sub-jurisdictional level.

In this context, the Supply Shed has two purposes:

1. **To incentivise investments for traceability**, by allowing the claim of mitigation outcomes generated in a Supply Shed (verifiably part of a value chain) where a set of requirements, such as traceability as per selected model, conservativeness, third-party validation, and verification have been complied with, and incorporating the impacts of Interventions in an emission factor (EF) that can be used for GHG accounting relative to the quantity of crops verifiably sourced from that Supply Shed. This is also known as market-based allocation or accounting where an Intervention takes place.
2. **To enable credible co-claiming and co-investment**, by allowing multiple parties to execute Interventions in a region where they source but may not directly influence their exact suppliers. This is also known as market-based attribution or defining where impact can be claimed.

Box 2. **Market-based mechanisms for accounting**

Following the market-based approach for Scope 2 accounting as set out in GHGP's Scope 2 Guidance,[3] an energy consumer uses the emission factor (EF) associated with the qualifying contractual instruments owned (e.g., North American REC market, Europe's Guarantees of Origin system). In contrast to the location-based method, this pathway enables the use of a contractual environmental attribute which may not be directly linked to physical/energy flows in the grid. The certificate does not necessarily represent the emissions caused by actual purchaser's consumption of electricity. In addition to this, GHGP's Scope 2 Guidance (section 7.1) requires organisations to present both the location-based and the market-based results for accounting and reporting.

We identify two major conceptual aspects to be tackled in the context of a potential application in the Food and Agriculture Scope 3 category 1 space:

A market-based allocation will be a procedure for attributing a verified quantity of GHG mitigation outcomes to a specific part of the modelled product system, for a period of time and a tracked quantity of goods, in a given Supply Shed.

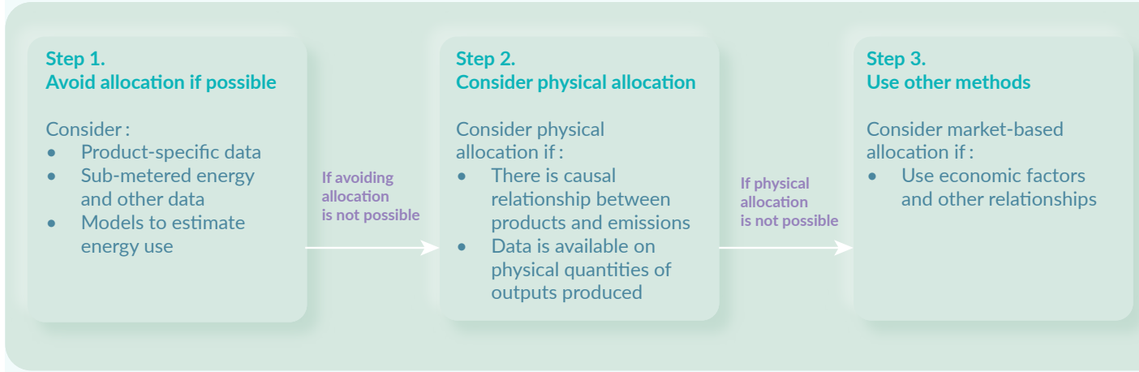

Figure 3. Decision process for allocation

In this context, a market-based allocation must be seen as the leveraging of an advanced market mechanism to enable trust-worthy partitioning of GHG emissions levels from a single system among its various outputs with economic value, using high-level and relatively inaccurate economic datasets.

A market-based attribution will be a procedure for attributing the "rights to claim" environmental benefits resulting from a value chain Intervention to legitimate supply chain participants. These "rights to claim" are available in proportion to those environmental benefits allocated to the originating commodity and its resulting co-products. The magnitude and ownership of the attributed benefits is recorded in a secure and transparent registry to avoid double counting and to facilitate the transfer of its attribution. The potential access to the benefits can be limited to economic actors active in the value chain linked to that Supply Shed.

3 GHG Protocol, World Resources Institute. (2015). *Scope 2 Guidance, An amendment to the GHG Protocol Corporate Standard.* URL: https://ghgprotocol.org/sites/default/files/standards/Scope%202%20Guidance.pdf

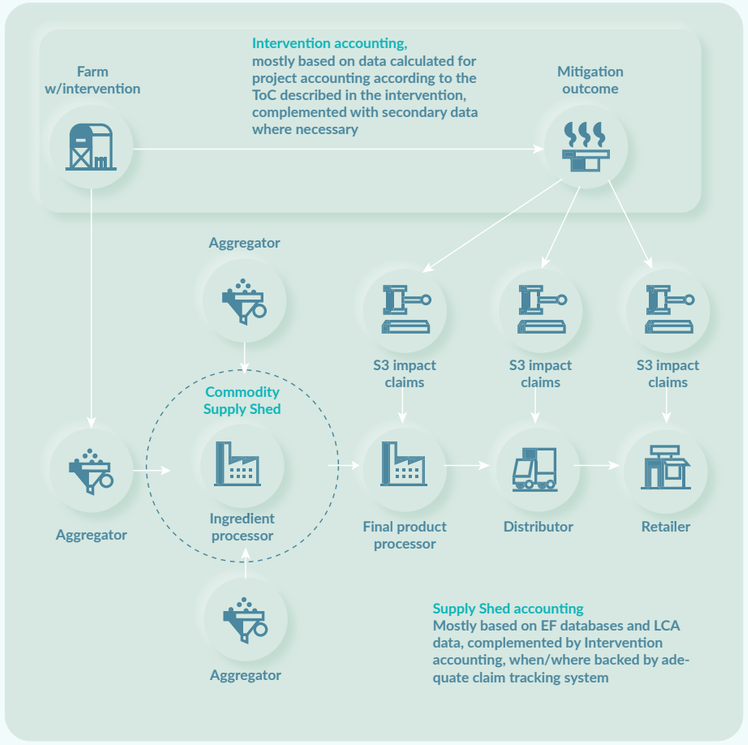

Figure 4. Agricultural Supply Shed

Note: Published GHGP Guidance requires traceability for removals reporting. However, the outcomes of the GHGP Land Sector Removal Guidance pilots (expected by Q2-2023) will determine the acceptance of a "sourcing region" approach for removals reporting.

3.2 Criteria for a credible Supply Shed

- → **Actionable:** A Supply Shed is a region on which the *Intervention owner*[4] is "capable of acting" (and reporting). The Supply Shed is defined in anticipation of needs beyond GHG impact, considering other SDGs (water, biodiversity, social, etc.).
- → **Auditable:** A Supply Shed allows the reporting for a specific Intervention accounting exercise including and not limited to primary and secondary data quality and GHG models. The Supply Shed enables the audit of a tracking system to guarantee credible attribution of mitigation to the traced product, and enables reporting at the landscape level (see Chapter 6 for further information on approaches to data management).
- → **Measurable:** A Supply Shed can be consistently measured as it has clear and consistent boundaries.
- → **Catalyser:** A Supply Shed is an additional layer of complexity for measuring, reporting, and auditing, and proponents must document and publicly share how it unlocks market potential to collaborate in creating incrementally higher quality information in the real world. As such, it should be based on commonly agreed boundaries, within which multiple stakeholders can individually act and contribute.

4 The *Intervention owner* role in this context is shared among the *producer* or farm owner and the company (or *buyer*) that co-invests to enable the changes and that intends to source (from the Supply Shed) the volume produced by the farm that has undergone the Intervention. Further areas to explore are the inclusion of input-suppliers and other value chain projects that are not currently represented.

Box 3. **Understanding the Supply Shed as a territorial unit**

The Supply Shed is defined as a national or sub-national region, however there is no maximum nor minimum size to indicate a *credible* Supply Shed. Track records from the Voluntary Carbon Market, corporate accounting space, and previous market-based mechanisms for GHG attributes show that there is no standard definition for the scale at which the generation, allocation, and attribution of mitigation outcomes linked to goods and services should be set.

To gain a better understanding and to strive for convergence, it is important to reflect on current research and policy frameworks that also build upon a geo-political region. As a first example, the implementation of the EU Biodiversity Strategy for 2030 (European Commission, 2020) utilises baselining and monitoring work conducted by the Joint Research Centre, European Environment Agency, DG Environment, and the European Topic Centres on Biological Diversity and on Urban, Land and Soil Systems for which data resolution ranges from 100 m to 25 km.
As a second example, the US-EPA published its Guidance on *Data Quality Assessment for Life Cycle Inventory Data* in 2016 including geographical resolution levels. These levels are codified according to the UN geo-scheme (United Nations, 2013).

Table 1. Data Quality Indicators Table

Resolution	A	B	C	D	E	F	G
Name	Global	Continental	Sub-Region	National	Province, State, Region	County, City	Site Specific
Example	World	NA	NA	USA	Ohio	Hamilton	26 W Martin Luther King Drive.

The Updated Data Quality Indicators Table, found in the same source, can be used by practitioners to assess the quality of a GHG quantification approach. The matrix gathers best practices identified and a ranking system for auditors. This covers the geographical representativeness for datasets used in GHG modelling. To be considered as best practice, the dataset must be built on data from the same resolution (as per Table 1), built to answer data needs of the area of study, and be representative of 80% of the relevant market. One interpretation of this for the Supply Shed would be that it can only be as big as the Intervention owner's capability to build datasets representative of market realities at the chosen scale.

3.3 Actionable criteria for a Supply Shed

1. The Supply Shed should host production of equivalent goods or services for a market, equivalency must follow ISO 14040 series, and any existing global product category rules (e.g., EU JRC PEFCR, EPD).
2. The Supply Shed should be defined by a physically defined region or jurisdiction linked to a Chain of Custody checkpoint[5] where an audit can be conducted on GHG attributes

5 That checkpoint is often the *Primary Processor*, but can also vary depending on the value chain realities. As per the *Accountability Framework Initiative Terms and Definitions* (2019), it is "a business, cooperative, or other entity that conducts the first stage of processing after an agricultural or forestry raw material is harvested". Examples include palm oil mills, slaughterhouses, oilseed aggregation and crushing sites, coffee wet milling facilities. As production of several farms must be aggregated, full-traceability/IP/segregation to a specific farm is often not achievable over the short term. Each Food and Agriculture value chain comes with its specificities and provides practitioners with potential checkpoints to anchor traceability data and enable potential establishment of assurance levels.

and quantities of impacted goods,[6] and where causality can be established. The delineation of the Supply Shed area should enable the identification of different eco-regions that may impact the baseline of the impacted scenario (one or more, based on delineation by eco-region and agro-ecological zones e.g., IPCC climate zones/FAO AEZ/EPA AEZ/USDA-NRCS LRRs/LRAs / EEA DMEER). In other words, stratum would need to be defined by eco-regions and jurisdictions where relevant in terms of regulation (e.g., different legal requirements).

3. The Supply Shed should support highly efficient inventory efforts, including a sampling exercise and quantification approach leveraged to make the case for the GHG mitigation outcomes generated and the Theory of Change (ToC).

3.4 Relation between Intervention, product or commodity, and Supply Shed

The Supply Shed enables the articulation of these two different levels of accounting — Intervention (at the farm level) and Supply Shed (landscape-wide).

→ **Intervention**: An umbrella term for any action (new technology, practice, or supply change) that introduces a change to a Scope 3 Activity to *reduce* or *remove* emissions. An Intervention may include several activities that reduce or sequester emissions in different ways and that may or may not be included within the Scope 3 Inventory.[7] Every Intervention has a defined ToC including rationales for impact generation. The implementation of the Interventions must verifiably occur within the operational boundary farm level, and the GHG impact of the entirety of the life-cycle of the solution must be quantified.

→ **Product:** A product is commonly the output of a system, and in this case, the outcome of an agricultural production system. These products are also known as agricultural commodities, which, depending on the market rules, can be raw or unprocessed goods (e.g., coffee cherries) or semi-processed goods that have undergone primary processing (e.g., green coffee). This product can have certain attributes which are provided in the data assigned within its traceability system (see ISO 14021:1999 and ISO 9000:2005).

→ **Supply Shed:** As per the definition in Section 3.1, this is a group of suppliers in a specifically defined market delivering functionally equivalent products to a given value chain through a particular Chain of Custody checkpoint. Different to the Interventions (farm level), Supply Sheds are landscape-level accounting entities.

The investment made by Intervention representatives and supporting partners enables the implementation of activities that constitute the Interventions. The Intervention fosters changes on specific parts of production systems and new datasets that were not available initially. Once the system completes a production cycle (e.g., one year for annual crops) and output production results become available, the mitigation outcomes derived from the Intervention are quantified and attributed to physical outputs of the production system (and for the Supply Shed outputs, a new EF can be calculated). The validation and verification process leverages the documentation to verify the credibility of the ToC, i.e., that an investment was made to foster an Intervention that acted on the drivers of the GHG emissions, which resulted in mitigation outcomes that can be attributed to a quantity of goods verifiably originating from that Supply Shed.

The Supply Shed is hence an operational and regional boundary within which a group or groups of operators can be verifiably established and proven to evolve towards more GHG-efficient production models. The reason for the introduction of an additional accounting concept such as Supply Shed is to catalyse improvements of individual oper-

6 There is also a potential concept of the "Primary Shed" that companies use in narrative claims, which typically refers to a country level, e.g., a U.S. Supply Shed, or the Canadian Supply Shed. It is ultimately an aggregation of different Supply Sheds or sourcing regions, and further implications for reductions accounting are yet to be explored.

7 Gold Standard and Value Change Initiative. (2021). *Value Chain Interventions – Greenhouse Gas Accounting & Reporting Guidance Version 1.1*. URL: https://www.goldstandard.org/sites/default/files/value_change_scope3_guidance-v.1.1.pdf

ators into a collective approach that can drive greater impact at the landscape level. At the inception of the Intervention, only individual operators generate impact (from which an improved EF can be derived). In the longer term, the Intervention triggers the adoption of best practices by a greater number of operators until the whole Supply Shed improves and impact is delivered at scale. The Supply Shed can support investors and value chain partners' efforts to efficiently monitor the implementation of the ToC, progressively allocate and attribute mitigation outcomes, and verify the permanence of the changes.

In terms of accounting, it is important to note that Intervention level is based on Intervention data, however Supply Shed accounting usually uses default LCA data, therefore they have different approaches. A proposed way to transition and improve data is provided in Chapter 5.

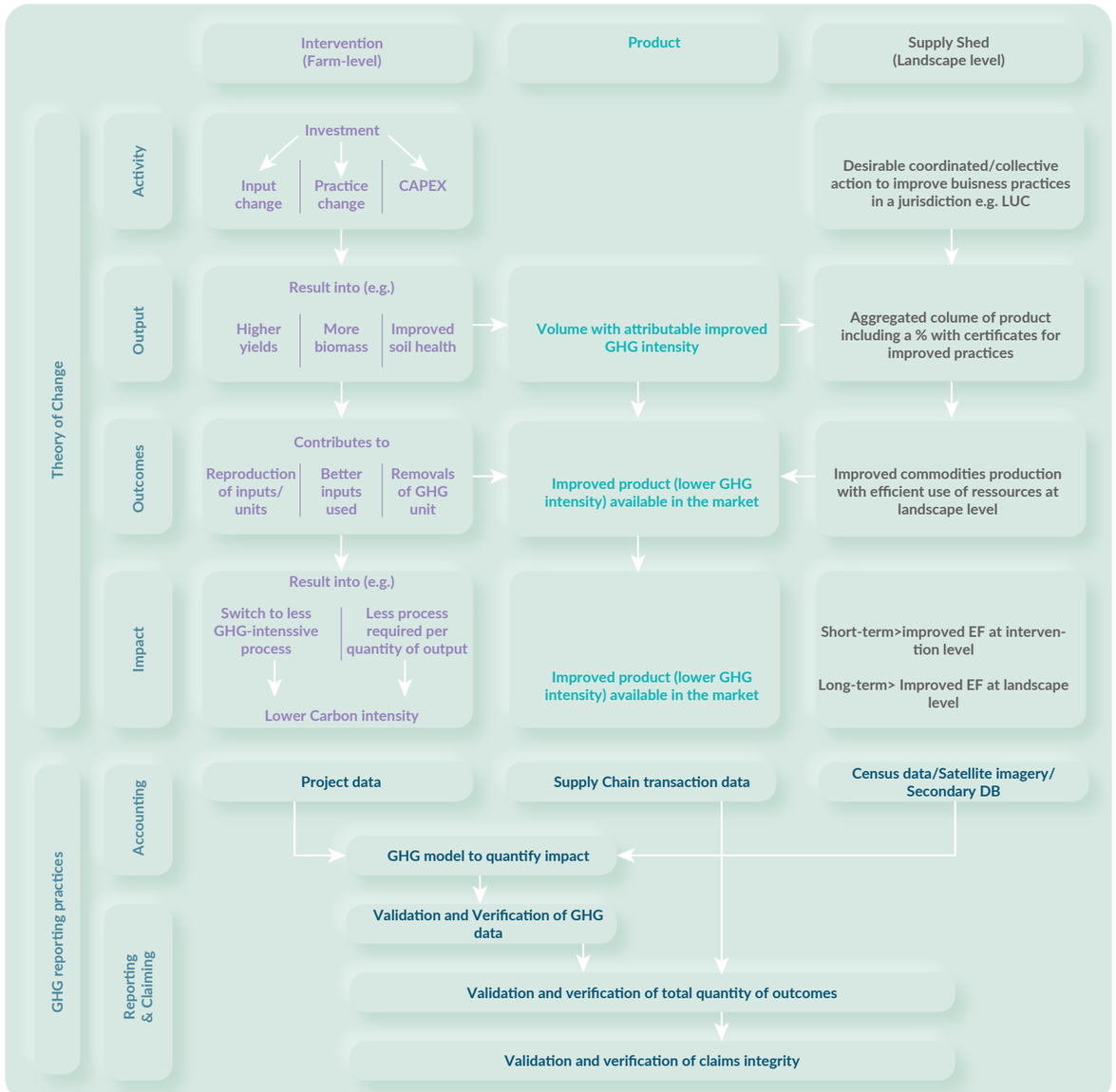

Figure 5. Relation between Intervention, product, and Supply Shed

Example 1. **A theoretical case with two Supply Sheds**

We have mapped two Supply Sheds, A and B, for a single commodity below. Each Supply Shed serves its own primary Chain of Custody checkpoint, except for a few suppliers that can serve both points. This is addressed via dedicated mechanisms (e.g., contracts).
In that context, we call an Intervention a set of practices promoted by an Intervention representative and implemented by farmers to lower GHG emissions and/or increase removals. We assume that suppliers show homogeneous characteristics within sub-Sheds, the only exception being eco-regions which represent the only significant differentiation factor for GHG emissions.
In Supply Shed A, there fully certified organic producers geographically dispersed throughout the Supply Shed. In Supply Shed B, there are different eco-regions, and each farmer within an eco-region can be a part of Intervention stratum.

- → Challenge 1: How can organic farmers in Supply Shed A be regrouped in stratum A1 and excluded for separate claims?
- → Challenge 2: How can Supplier 2 be identified from Supplier 1 and mitigation outcomes that come with their production be attributed through Supply Shed A **OR** Supply Shed B?
- → Challenge 3: How can auditable evidence be established to make the case for causality, GHG improvement, and tracking of low-carbon goods at the level of each Intervention stratum B1/B2/B3?

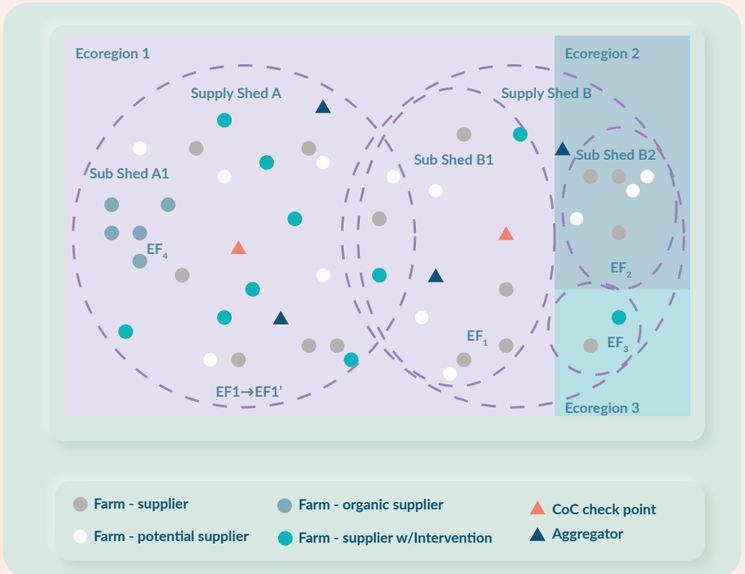

Figure 6. Illustration of the example

The main risks are:

- → Mitigation outcomes generated by organic certified suppliers may already be claimed by organic product buyers.
- → Mitigation outcomes generated by Supplier 2 must be only claimed within one Supply Shed.
- → Mitigation outcomes profiles are calculated by sub-Shed/stratum in order to avoid full monitoring and traceability, and that approach must be documented for assurance.

This set of selected challenges must be addressed in order for organisations to safely deploy a Supply Shed approach.
Another important aspect is that if a supplier is part of the same market (delivering the same functional product) but geographically falls outside the region/jurisdiction identified as Supply Shed for a given Intervention (a few kilometres out of the jurisdiction), but can be proven to serve the same Chain of Custody checkpoint, the Intervention representative can make the case for the inclusion of that supplier by documenting adequate evidences (e.g, farmer mapping, transaction invoices, proof of investment).

3.5 Examples of sector-specific Supply Sheds

As the acceptance of Supply Sheds for accounting exercises broadens, a community of lead practitioners should aim to develop the adequate level of traceability and ensure auditability. Supply Sheds are the backbone for collaborative investment hence the data derived from them is likely to become mainstream when due diligence is applied to climate impact investing.

Food and Agriculture value chains present specificities driven by the nature of the good produced and maturity of the value chain in the study's geography. The three examples presented here were framed on the VCI Working Group's feedback and aim at covering three typologies of value chains (and potential framing of VCI strategies): bulk commodities, high value mono-ingredient value chains, and multi-ingredient value chains.

For the palm oil sector, traceability up to refinery level is enforced in best-in-class value chains.[8] Supply Sheds are organised per jurisdiction within countries of origin that have proper compliance frameworks to ensure that sustainable practices are implemented within the administrative boundaries. The entirety of the commodity being produced transits through identified mills that all deliver to the same refinery. In that case, the Supply Shed defined by organisations for their Intervention would be expected to align with pre-existing jurisdictional approaches to avail from pre-existing sustainability datasets.

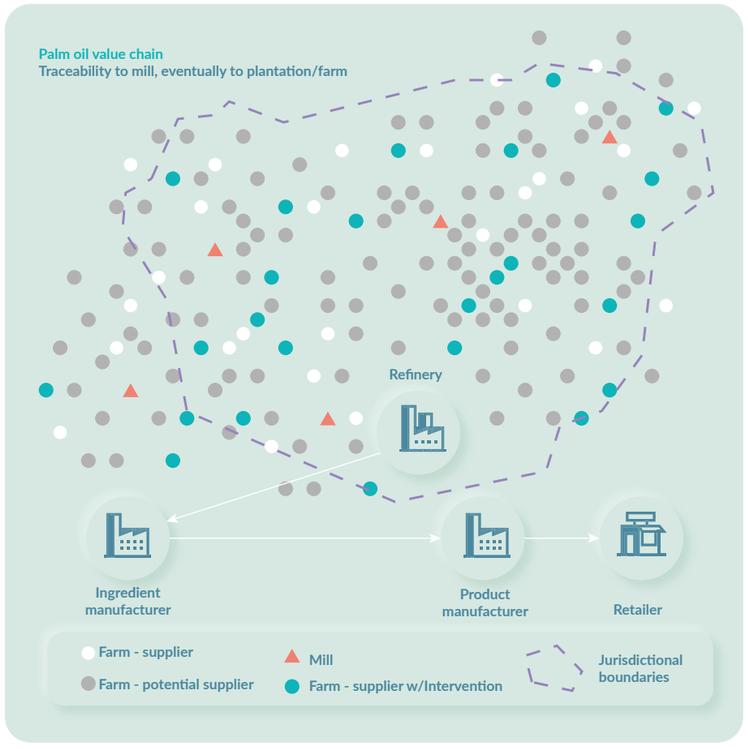

Figure 7. Example of Supply Shed in palm oil

In other sectors, for example the dairy sector, processing plants are likely to fall far from the jurisdiction where the commodity is produced. This brings great challenges to the definition of an actionable and auditable Supply Shed. It is proposed that Supply

8 CDP. (2022). *Measuring Progress Towards a Sustainable Palm Oil Supply Chain, A company's journey.* URL: https://cdn.cdp.net/cdp-production/cms/reports/documents/000/006/522/original/CDP_Palm_Oil_Report_2022_Final.pdf

Sheds are defined based on traceability provided by collection centres that deliver to a processing plant. In practice, the initial proposal for the definition of a Supply Shed would be left to the Intervention representative's discretion. It should enable the establishment of reasonable assurance regarding the allocation of volumes of mitigation outcomes to goods impacted.

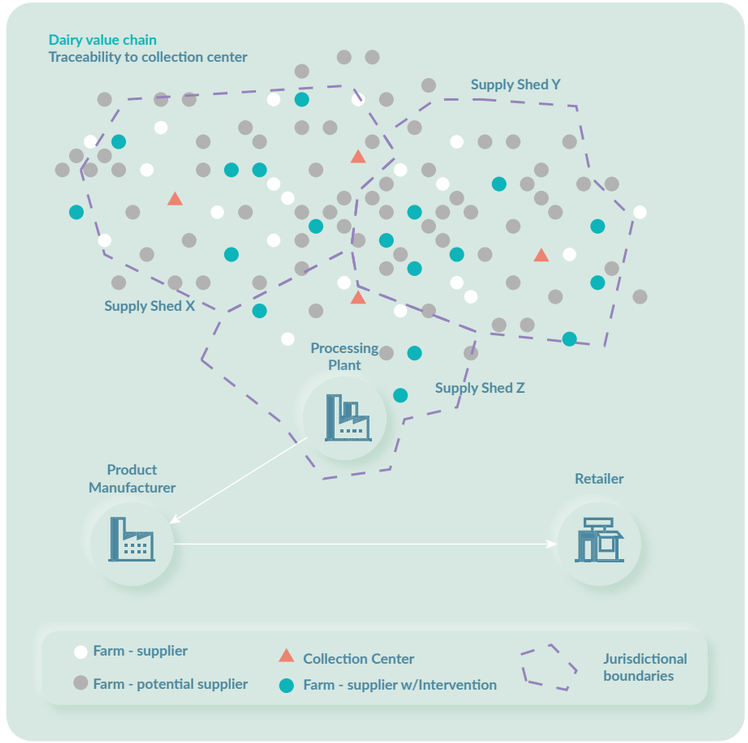

Figure 8. Example of Supply Shed in dairy

Other sectors with single high-value key ingredients and historically more mature traceability and physical segregation due to voluntary or mandatory sustainability practices, would have a similar approach. For example, in a coffee value chain with a mixed level of traceability to the farm (some farms have full traceability and physical segregation for sustainability certification or quality differentiation), the whole Supply Shed would deliver to a wet mill or cooperative (coffee cherries), or a buying centre (in parchment). This point must then be used as the CoC checkpoint at jurisdictional level to ensure that any potential claim on coffee with full traceability is not already accounted for in the sustainability certification scheme.

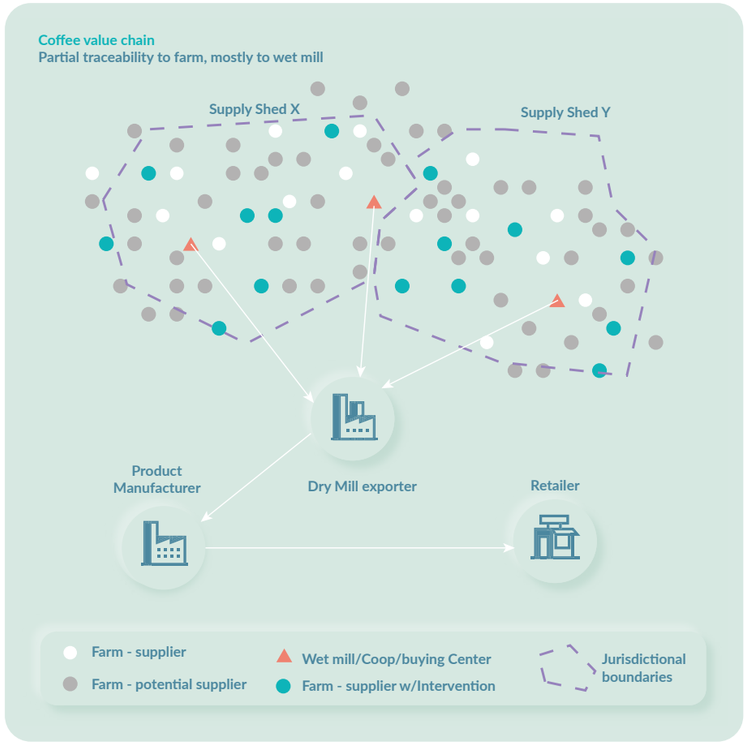

Figure 9. Example of Supply Shed in coffee

This high-level exploration shows that pragmatic solutions exist for Intervention representatives and depend on sectoral practices:

- → **The potential CoC checkpoint available for an Intervention's anchoring depends on the current infrastructure in the value chain and its level of traceability already in place**. This does not mean that the current level of traceability should be the desired end-state. Improvement actions to enable better traceability are recommended as part of the continuous improvement trajectory and could be seen as a sound enabler for beyond value chain mitigations.
- → **Optimal supply chain networks should be assumed.** Supply Sheds are not static, and it is understood that the quantification approaches will need to be revised based on supply base dynamics. A farm could sell its products to two different CoC checkpoints in different Supply Sheds, and there could be year-on-year variability. A given producer could potentially fall outside the jurisdictional boundary of the Supply Shed but still be geographically close.
- → **Sub-jurisdictional division might be needed if the context is not homogenous in its characteristics that drive climate impact**. For example, if there are two eco-regions within a jurisdiction, then there is a case for creating two sub-Sheds.

For future exploration:
During the exploration on the definition of the Supply Shed, we have identified potential research questions:

- **Are there archetypes of Supply Shed according to the specific types of Supply Shed?**
  (E.g., bulk commodities, high value commodities.)
- **How can the Supply Shed concept be used to incentivise and reward both collective and individual action?**

4.

Safeguards and representativeness for intervention accounting

This chapter proposes a framework to assess uncertainty in datasets used for GHG modelling, some of which come from the LCA space. While the LCA framework is widely applicable across sectors, it is not the only framework that can be applied in GHG accounting. The approach proposed here aims at making the best use of existing data available and incentivises the collection of high-quality primary data where and when it matters. In practical terms, a dedicated quantitative approach is required to assess the quantities of mitigation outcomes including the uncertainty relative to the parts of the emission factor (EF) that are impacted by the Intervention. For the rest of the EF, a quantitative approach is preferrable, and other solutions exist.

Challenge identified:
Credible GHG accounting requires high quality data to safeguard accuracy and conservativeness. In the context of "imperfect" data and limited availability, the question is, what "good" is "good enough" for an organisation to be able to measure and account for mitigation outcomes? Although there are assessments for data quality in GHG frameworks (e.g., PCAF data quality score[9]), it is important to consider solutions that align with the LCA domain.

Relevance:
Assessing how representative data supports conservativeness in GHG accounting. Although this is not a solution that can be applied exclusively to the Supply Shed, it supports its application in accounting since Supply Sheds are highly dynamic by nature.

9 A data quality scorecard-based system has been developed by PCAF to support financial institutions in removing the barriers to credible GHG accounting in the absence or limited availability of high quality data. Further information can be found in the *Financed Emissions Global GHG Accounting & Reporting Standard Part A.*
URL: https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf

4.1 Context: Representativeness and uncertainty

Representativeness and uncertainty are set as key pillars for enabling credibility in accounting for Interventions by leading GHG accounting standards (ISO and GHGP, among others). They enable actors to quantify and communicate their ability to understand and factor in variability in GHG models and, as a result, provide the basis for a conservative approach. For emissions accounting, several packages of information are used as input (databases, models, primary and secondary datasets). The uncertainty of models and secondary datasets also influences how *representative* the resulting output can be in estimating emissions of a certain scenario.

Note: Life Cycle Assessment (LCA) models and tools are used as a reference as most of the databases and models used for carbon accounting are closely related to the domain of LCA. Alignment and harmonisation are recommended, rather than creating solutions that will ineffectively replicate existing ones partially or totally.

4.2 Definition of uncertainty

Uncertainty implies that in all situations for which we aim at estimating GHG emission levels, there is imperfection in data and aspects affecting emissions that remain relatively unknown. Inventory and modelling efforts come with uncertainty distributions that are used to estimate emissions levels (in CO2e). This line of thinking is critical for corporate accounting as a major potential challenge results from the imperfect quality and representativeness of sustainability data and must be mitigated.

Within a Supply Shed, an organisation can dynamically adjust how uncertainty is assessed in GHG calculations. This happens through progressive building of technical knowledge on populations of interest within the boundaries of Intervention, including on variability of key performance indicators. These populations of interest, regrouped in *strata*, share common characteristics and can be modelled. The Intervention representative can make the case for a representative shared baseline and Intervention scenarios. In the case where representativeness would be seen as insufficient, additional sampling efforts could be targeted at that stratum.

4.2.1 Elements of uncertainty

In the realm of LCA, uncertainty is organised in several categories. As per ISO 14044, uncertainty analysis is the "systematic procedure to quantify the uncertainty introduced in the results of a life cycle inventory analysis due to the cumulative effects of model imprecision, input uncertainty and data variability."

→ **Data variability and input uncertainty:** Natural variability of input data that will be factored into the models, e.g., measurement uncertainties, activity-specific variations, temporal or spatial variations (Weidema *et al.*, 2013).

→ **Model imprecision**: Variability of secondary LCA processes which arise from the use of estimates, lack of verification, incompleteness in the samples and/or extrapolation from temporal, spatial and/or technological conditions (Weidema *et al.*, 2013).[10]

This addendum advocates in favour of giving special attention to model imprecision, particularly to the effects of **contextual uncertainty** as the eventual lack of fit between available LCA processes and organisations' real-world conditions. Contextual uncertainty is further explored in this document and is key to showcasing the importance of organisations' investment in better sustainability data.

10 Weidema, Bo & Bauer, Christian & Hischier, Roland & Mutel, Chris & Nemecek, Thomas & Reinhard, Juergen & Vadenbo, Carl & Wernet, G. (2013). *Overview and methodology. Data quality guideline for the Ecoinvent database version 3.* URL: https://www.researchgate.net/publication/272131030_Overview_and_methodology_Data_quality_guideline_for_the_ecoinvent_database_version_3

4.3 Solution proposed: Addressing uncertainty in Intervention accounting

Box 4. **What changes do we suggest for managing uncertainty?**

Although dealing with uncertainty in accounting is not new, the present guidance introduces new thinking in the ways of interfacing approaches to assess and quantify uncertainty in input data from both organisational and project GHG accounting.

The thinking also encompasses data quality questions beyond variability such as data collection process quality assurance and quality control (QAQC) and key drivers of representativeness. The investment to improve the quality of data leads to a better representativeness level which results in a more accurate and precise quantity of outcomes for the Intervention considered. Current approaches are usually conducted at a high/aggregated level which does not enable the establishment of an agile strategy for uncertainty management. It is likely that these legacy approaches will not be refined enough for organisations to achieve future requirements for Net Zero targets.

With best practices from project accounting, where more granular and robust inventory efforts are conducted at a smaller scale, Intervention representatives can maximise the credibility and quantity of mitigation outcomes generated.

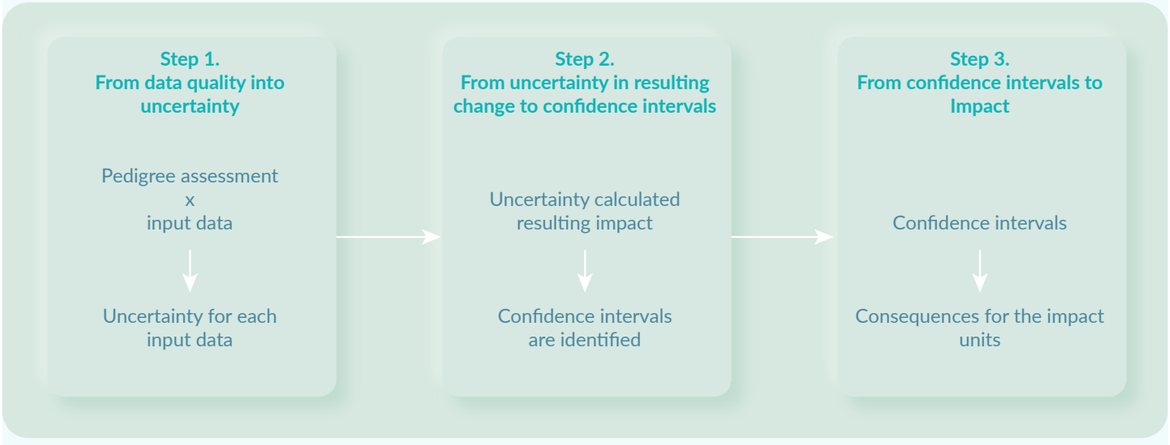

Figure 10. From data uncertainty to impact claims

Uncertainty plays a role at different stages in the calculation to determine the quantity of mitigation outcomes that can be claimed. First, uncertainties of data input are measured through data quality assessment (partly covered in this guidance). The results are used to define the threshold for establishment of reasonable assurance to the quantity of mitigation outcome to be generated by the Intervention. This is done by running different scenarios for the outcomes. Based on this data, we can reliably say that impact in any probable scenario is represented within the output distribution, and with that, a confidence interval or percentile in information can be selected.

The process of accounting for uncertainty outlined here aligns with GHGP and IPCC guidance. However, none of the existing guidance indicates a methodology to extract a single score. As a result, a percentile must be selected to indicate the level of trust in output calculations (e.g., the 50th percentile or median). Hence, depending on the confidence level, the impact units generated must vary (e.g., selecting a confidence level of 70% could result in ~80% of Impact Units issued, to ensure conservativeness is applied).

To model uncertainty within an accounting model, a range of probable values are used rather than a single static number. This range is provided by a log normal distribution that captures the values.

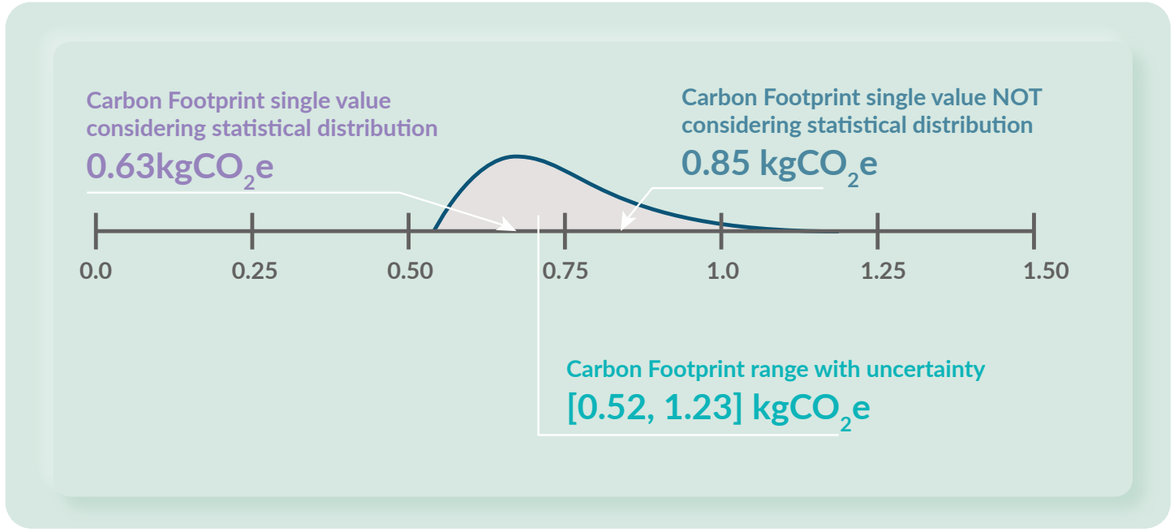

Figure 11. Carbon Footprint static versus Carbon Footprint with uncertainty

Uncertainty management and quantification is to be applied in emission accounting to:

1. Define amounts of inputs and select secondary datasets used in the modelling of a product, addressing variability on all the probable situations.
2. Assess uncertainty of primary datasets collected and built to enable Intervention accounting.
3. Aggregate all layers of uncertainty into a comprehensive and trustworthy report that will support quality and quantity of mitigation outcomes.

In this addendum, the focus is on assessing the uncertainty of datasets.

Note: Chapter 3 of the IPCCC Guidelines provides guidance to calculate uncertainties associated with both annual estimates of emissions and removals, and emission and removal trends over time.[11]

4.3.1 Addressing uncertainty in datasets

Assessing data fit is key to understanding and improving data quality. There are several tools that can be used to assess data fit and/or quality for the need of a particular GHG accounting exercise. The solution proposed is twofold. First, the modelling effort to quantify mitigation outcomes at the level of an Intervention is accompanied by comprehensive reporting, including on uncertainty. Second, the systematic application of quantitative assessment of uncertainty where possible, or if not possible, scoring using a pedigree matrix from corporate accounting and other GHG modelling frameworks.

The pedigree matrix is a tool recommended by GHGP Protocol to generate quantitative uncertainty distributions from qualitative data quality indicators (DQIs), and is used in major LCA databases such as Ecoinvent, AgriFootprint, or GaBi. Combined with techniques such as Monte-Carlo simulation, the pedigree matrix quantifies the uncertainty distribution of emission reductions in the context of imperfect Chain of Custody and sustainability data required for GHG models. VCI expects that the pedigree matrix will

11 IPCC. (2006). *Guidelines for National Greenhouse Gas Inventories. Volume 1. General Guidance and Reporting.* URL: https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html

need to evolve to better make the business case for more robust emission factors, and be built on a larger percentage of primary datasets to enable the accounting of Interventions in the context of proven causality within a ToC-compliant framework.

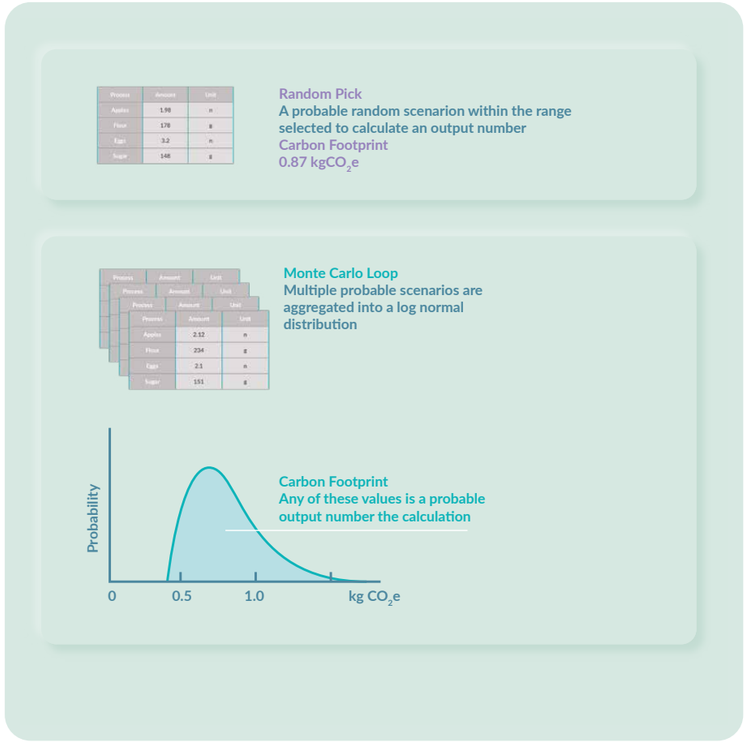

Figure 12. Ways to quantify uncertainty

A pedigree matrix can assess data fit according to the following categories:[12]

- → **Reliability** is the degree of "goodness" to which the data itself is generated from reliable sources with scientific robustness.
- → **Completeness** is the degree of coverage or percentage to which all required data is known from the relevant sites.
- → **Temporal correlation** is the degree of representativeness to which the data reflects the true population of the underlying study regarding the time/age of the dataset. It measures the time difference between the reference data and the underlying study.
- → **Geographical correlation** is the degree of representativeness to which the data reflects the true population of the underlying study regarding the location of the dataset.
- → **Technological correlation** is the degree of representativeness to which the data reflects the true population of the underlying study regarding technology applied in the field of interest.

12 Chen, Xiaobo & Lee, Jacquetta. (2020). *The Identification and Selection of Good Quality Data Using Pedigree Matrix.* 10.1007/978-981-15-8131-1_2.
URL: https://www.researchgate.net/publication/344268534_The_Identification_and_Selection_of_Good_Quality_Data_Using_Pedigree_Matrix

Table 2. Pedigree matrix used in Ecoinvent

DQI/Score	1	2	3	4	5
Reliability	Verified data based on measurements (experimental data)	Non-verified data based on measurements or verified data based on calculation (historical/ calculation data)	Non-verified data based on calculation or partly based on qualified estimates	Qualified estimates (e.g., expert judgements) or educated guesses	Non-qualified estimates or uneducated guesses
Completeness	Data from all sites relevant for the market considered (>80%)	Data from sites relevant for market considered (60-80%)	Data from sites relevant for market considered (50-60%)	Data from only one site relevant for market considered (<40%)	Unknown
Temporal correlation	Less than 3 years of difference	Less than 6 years of difference	Less than 10 years of difference	Less than 15 years of difference	More than 15 years
Geographical correlation	Data from area of study	Data from larger area in which area of study is included	Data from outside area with similar conditions	Data from outside area with slight similar conditions	Data from unknown or distinctly different area
Technological correlation	In-house data (known process and materials)	Data of the same technology from other enterprises	Data from processes and materials under study but from different technology	Data on related processes or materials (proxy)	Data on laboratory scale or from different technology

Box 5.

How will the pedigree matrix evolve to make the case for better data in the context of Intervention accounting?

Establishing thresholds for each criterion while aiming at qualifying a baseline emission factor and calculating post-Intervention EF is critical for organisations' NetZero strategies as it will be setting the minimum qualifying quality thresholds for sustainability data. The VCI seeks to maximise convergence in the set of methodological and technical tools available for the development of sustainability strategies. This can be done, for example, through the implementation of highest scoring thresholds for data quality in product-specific GHG modelling guidance. E.g., Product Environmental Footprint Category Rules for dry pasta Table 5-3, published in alignment with Product Environmental Footprint (PEF) Guide, ISO 14025:2006, ISO 14040-44:2006, and the ENVIFOOD Protocol, can be leveraged to outline a potential advanced data matrix for Intervention accounting which would include, among others, the following criteria:

→ Publication of an emission factor report within the time validity of the dataset (1 year)
→ Dataset built on measured, calculated, and externally verified data

The VCI cautions that over-investment in obtaining perfect sustainability data would prevent investment at scale for impact, which would go against the initiative's purpose. On the contrary, the argument should not be used to refuse any investment in favour of better sustainability data at Intervention level.

Each combination of category and score has a specific impact on overall uncertainty and has been determined by empirical studies on differences in LCA data across the categories and scores. As Figure 13 shows, technological correlation is the category that impacts the most, meaning that datasets which are based on a different technology will result in a higher uncertainty in the accounting.

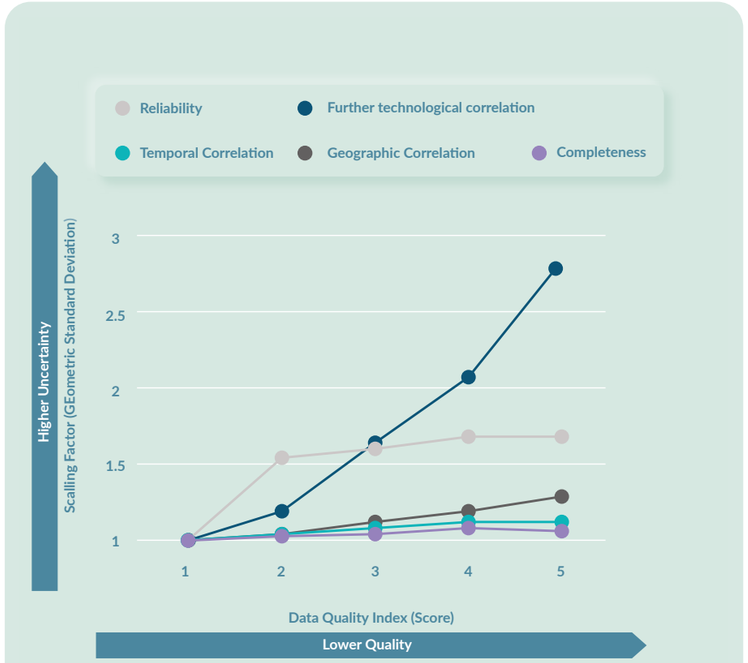

Figure 13. Impact factor per category based on the Pedigree from Ciroth et al. (2013)[13]

The scores generated through the pedigree matrix assessment are then used to calculate a total geometric standard deviation (GSD) for a lognormal distribution. The lognormal distribution is a probability distribution widely used in LCA as it is seen as the best way to model probabilistic distribution of a multiplication of many small independent factors.

Equation 1. GSD calculation from Ciroth et al. (2013)

$$GSD(x) = EXP\sqrt{\frac{1}{n}\sum_{1}^{n}\ln\left(\frac{xi}{xg}\right)^{2}}$$

The GSD is calculated following Equation 1 (where "xg" is the geometric mean of x) and describes the spread of probabilistic distribution of x. The lower the GSD, the narrower the distribution.

13 Ciroth, Andreas & Muller, Stéphanie & Weidema, Bo & Lesage, Pascal. (2013). Empirically based uncertainty factors for the pedigree matrix in ecoinvent. The International Journal of Life Cycle Assessment. *21*. 10.1007/s11367-013-0670-5. URL:https://link.springer.com/article/10.1007/s11367-013-0670-5

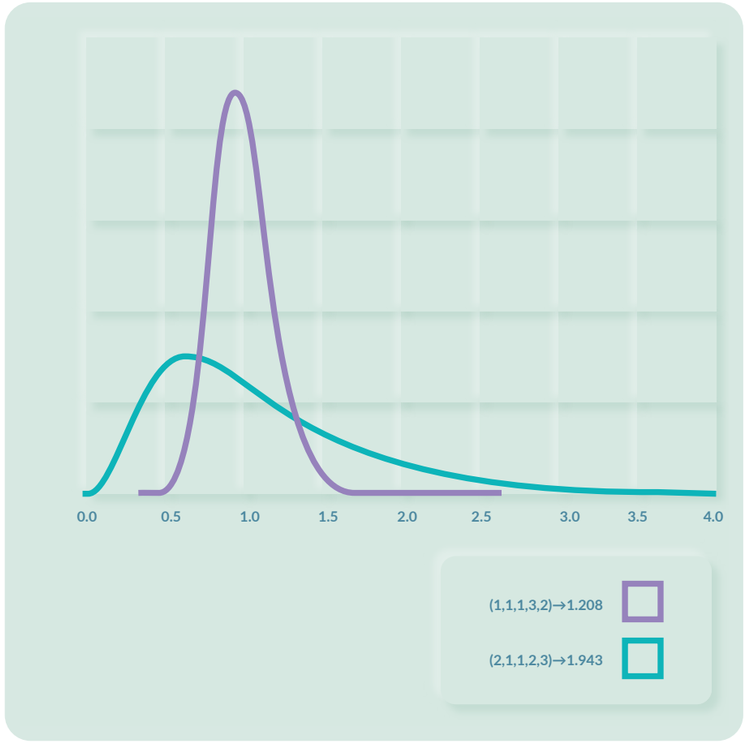

Figure 14. Potential distributions calculated with GSD

Figure 14 shows different GSD generated with different outputs from the pedigree matrix.

A very narrow distribution implies that the uncertainty is relatively low, as any probable value is close to the geometric mean (1.0 in that case).

A wide distribution means the uncertainty is high as any probable value is far from the geometric mean. Note that this wide distribution is the result of a pedigree assessment with low quality data for technological correlation, which means that using that any dataset where the processes are based on a different technology than that which is used will have high uncertainty, as the range of values is wide.

When assessing multiple datasets for a product, they are all aggregated into a Monte-Carlo loop, to generate an overall uncertainty distribution. The resulting distribution will illustrate the aggregated uncertainty for the full dataset used in the accounting and will help determine the possible values for a carbon footprint.

4.4 Outcomes of assessing uncertainty

As mentioned above, assessing uncertainty enables credibility and supports the credible adherence to the conservativeness principle. Organisations need a standardised way to assess how the data enables credibility by gaining increased clarity on how GHG emissions are measured and or modelled. In the future, it is expected that quantities of mitigation outcomes are directly related to this uncertainty, e.g., for low uncertainty in accounting, a higher number of impacts can be declared.

Example 2. **Using the pedigree matrix to assess data quality**

There are multiple strategies to answer the challenge of assessing data quality for GHG modelling. An example of best-in-class content can be found in ISO 14044 4.2.3.6, with a high level of detailed requirements for representativeness, reproducibility, and consistency. Here, we display an example from another high-quality source as a complementary example as it illustrates how these approaches are already well established.
Example: When collecting data to understand the inputs for making an apple pie, a dataset for an input is being assessed in the pedigree matrix with the following criteria or features:

- → The data comes from a region in the USA
- → It has been collected through surveys and other direct measurements
- → The data is measured but not verified
- → Coverage is around 50% of the market
- → The data is spread across the last three years
- → The data contains sets from the area of study, and other datasets include a larger region
- → The data shows that the same technology (gas oven) is used broadly among the apple pie bakers

Table 3. Pedigree matrix assessment for example

	1	2	3	4	5
Reliability	Verified data based on measurements (experimental data)	Non-verified data based on measurements or verified data based on calculation (historical/ calculation data)	Non-verified data based on calculation or partly based on qualified estimates	Qualified estimates (e.g., expert judgements) or educated guesses	Non-qualified estimates or uneducated guesses
Completeness	Data from all sites relevant for the market considered (>80%)	Data from sites relevant for market considered (60-80%)	Data from sites relevant for market considered (50-60%)	Data from only one site relevant for market considered (<40%)	Unknown
Temporal representativeness	Less than 3 years of difference	Less than 6 years of difference	Less than 10 years of difference	Less than 15 years of difference	More than 15 years
Geographical representativeness	Data from area of study	Data from larger area in which area of study is included	Data from outside area with similar conditions	Data from outside area with slight similar conditions	Data from unknown or distinctly different area
Technological representativeness	In-house data (known process and materials)	Data of the same technology from other enterprises	Data from processes and materials under study but from different technology	Data on related processes or materials (proxy)	Data on laboratory scale or from different technology

Based on this information, the data quality scores are (2, 3, 1, 2, 2) with a GSD of 1.593. This means that the resulting distribution (below) of values tends to be narrow. The narrower the distribution, the more credible the emissions reductions, and therefore – using a conservative approach (to be defined) – a higher amount of Impact Units can be issued. This in turn provides an incentive for higher data quality.

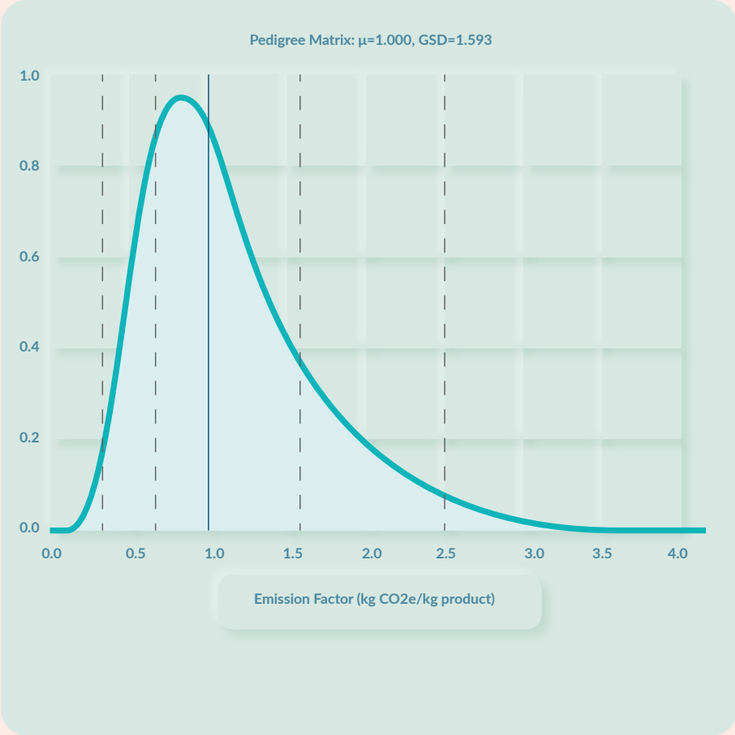

Figure 15. Normal distribution resulting from the assessment with Table 3.

5.

Leveraging project accounting in inventory accounting

This chapter proposes a methodology to improve inventory data using LCA frameworks. While the LCA framework is widely applicable across sectors, it is not the only framework that is applied in accounting.

Challenge identified:
As organisations invest in data and accounting for their Interventions, improved sustainability datasets are available to better understand inventories. Although traditionally, inventory and Intervention accounting do not follow the same principles, and there is currently no established way to leverage more granular Intervention data, new guidance (e.g., the GHGP LSRG) includes principles of project-based accounting for inventory. Combining both methods to inform decision making will be advised in future guidance.

Relevance:
Leveraging project accounting practices to better understand inventories is important for gaining better insights when selecting Interventions, and for strategic decision making in the organisation (e.g., for sourcing strategies). For Supply Sheds, it is important because it enables a better understanding of the behaviour and impact of the Supply Shed as an entity, as this approach would allow interfacing Supply Shed data (LCA-based) with Intervention data (project-based).

5.1 Definition of interfacing

Interfacing means leveraging project or Intervention accounting methods to improve inventory accounting methods. In short, it means better data. Interfacing does not mean integrating avoided emissions into organisation accounting.

To credibly account and report benefits of an Intervention, emission data must be consistently accounted in a way that allows for verifiable comparisons of inventory, baseline, and post Intervention EF. This must be done in a transparent way to comply with the GHGP accounting principles. Interfacing can provide consistency in the calculations.

Box 6. **Improving inventory accounting: Current state and suggested improvements**

One key purpose of inventory accounting is to identify an organisation's emission hotspots and evolution of emission profiles over time. It currently provides a comprehensive overview of emissions at a high level only, which is a serious limitation to the usability of outputs for strategic decision making.

Through an in-depth mapping of all relevant sub-processes within the inventory exercise, the best opportunities and processes for emissions reduction and removal can be replicated or even automatised. This improvement in practices enables the automatised identification of best opportunities for impact and investment in Interventions (with required higher quality sustainability data to account for it). Figure 16 illustrates the targeted degree of transparency that companies would be able to provide while prioritising the processes for Intervention -highlighted in a pattern below.

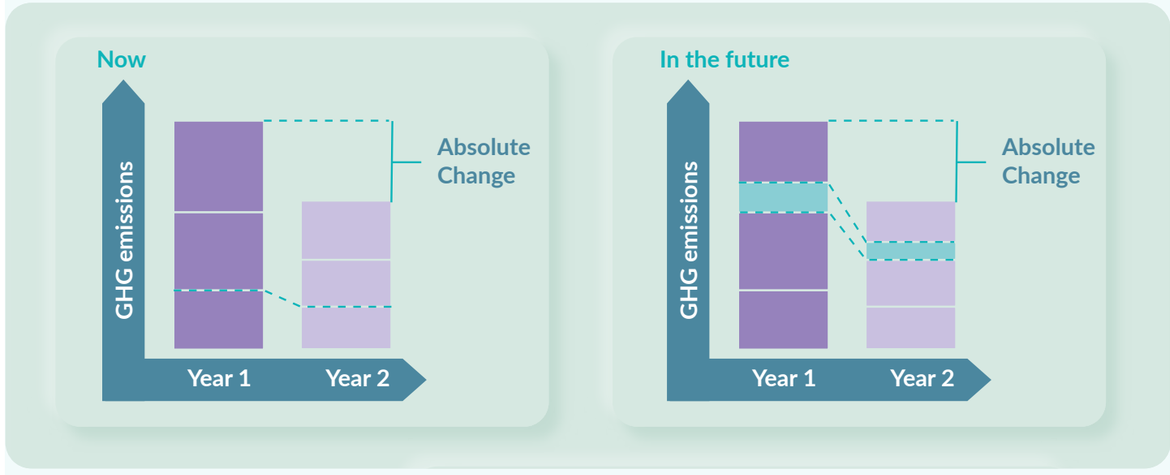

Figure 16. Outlook for improving granularity of inventory accounting

The substitution method is described in the VCI 1.1 Guidance. This document explores the details of the framework to allocate mitigation outcomes to adequate processes and attribute emissions to organisations, proposing a hierarchy in the different levels of data available.

As per ISO_DTR_14069, organisations may report GHG emission reductions or removal enhancements purchased or produced from GHG projects, using methodologies such as ISO 14064-2 and UNFCCC-derived mechanisms to meet overarching GHG strategy goals (e.g., Net Zero). GHG mitigation outcomes resulting from GHG initiatives within the company value chain can be reflected in the organisation's GHG inventory or exported *outside* GHG inventory boundaries. If exported, for example, under the form of a credit or environmental attribute certificate linked to a quantity of goods, the organisation shall document the transaction (GHG quantities, goods and services quantities,

inventory boundary impacted) and report for associated GHG emissions separately.

Numerous best practices were developed in the spheres of project accounting, directly derived from ISO 14064-2 and UNFCCC's scheme, among others. These protocols can be deployed to efficiently raise the bar in terms of data quality for an Intervention happening in each Supply Shed.

Box 7. **The case for better sustainability data**

The quality of sustainability data usually poses a risk since GHG inventories are used to establish Value Chain Abatement, BVCM, and Net Zero targets. At the time of writing, there are no comprehensive standard data quality requirements for GHG inventories in Food and Agriculture value chains. This constitutes a challenge to define what "better data" or "good enough" data can mean.

Better data can be firstly characterised by the fact that it includes more primary data (i.e., organisation-specific, context-specific and measured/modelled for the exercise). It provides the best insights on potential hotspots and opportunities for reduction and removal in the value chain. Intervention GHG accounting based on primary data with a reasonable certainty has a greater chance to enable organisations to maximise the credibility and quantity of mitigation outcomes derived from Interventions deployed in their value chains.

Across the board, the VCI Working Group detected and gathered signs of upcoming rules and regulations that will ("shall") require reporting organisations that set credible Net Zero targets to justify their selection and use of datasets. The justification would need to encompass rationale for defining what data is most representative and justify the use of default data with clarification of impact on uncertainty for mitigation outcomes.

5.2 Solution proposed: Method for deploying interfacing

To leverage project and Intervention accounting, a perfect understanding and documentation of how impact is to be measured and allocated is required, then attributed post-verification to be accounted for. In this document, the GHG modelling process is presented for both improving inventory, and for accounting impact.

To illustrate how interfacing can be conducted, the basic equation considered to calculate the net emissions for a process is introduced as:

Equation 2. Basic formula to calculate emissions for targeted process

EAP = EF x D

Where:

- **EAP** = the total net emissions associated with the targeted process
- **EF** = the emission factor associated with the targeted process
- **D** = the process demand or the amount of input needed to execute the process for 1 kg of product (e.g., to produce 1 kg of bread, 1.1 kg of flour is needed)

Step 0. From Intervention to product

Priority should be given to establishing and verifying the relation between outputs of the project accounting exercise and quantities of goods and services. These goods should be reasonably traced back to the Supply Shed and time frame of Intervention. This enables the integration of Intervention information into the inventory workstream. It is important to note that this is only possible when the whole life cycle of the solution, including potential adverse GHG effects, is considered and verified.

Step 1. Mapping the data

All the processes are mapped using a recognised product system framework. A product system is a network of child and parent goods at different steps in the supply chain, and a combination of a good and an impact layer is called a product system link. An example of a framework that is used to map generic value chains is shown in the table below:

Table 4. Example of process mapping

	Process 1	Process 2	Process 3	Process 4	Process 5
Process	Raw material	Mid product	End-product	Market, wholesaler	Market, retailer
Sub processes	• Production • Transport • Aggregation	• Sourcing • Processing • Packaging • Storage	• Sourcing • Processing • Packaging • Storage	• Sourcing • Processing • Packaging • Storage	• Sourcing • Processing • Packaging • Storage

The value chain includes a description of the product system, co-products, competitive usages with mass balance and allocation rules specific for the market where the Intervention is taking place. The process mapping presented in the table above is general and should be adapted to specific value chains. When mapping the processes, three principles should be considered:

→ **The quantification approach boundaries must cover all relevant steps in the value chain to guarantee the credibility of mitigation outcomes and must facilitate the correct allocation of the mitigation outcomes to be reported in different GHG corporate accounting categories**. For instance, impact claims should consider Scope 3 category 1 boundaries with "*cradle to gate*" processes, while other processes could be relevant for other categories, such as upstream transportation (category 4), waste treatment (category 5), etc.

→ **The quantification approach is mapped to processes that constitute the EF. Each specific way of executing activities targeted by the Intervention can utilise different processes and different values of processes. Therefore, each process has only one specific EF.** If the Intervention presents an alternative process (e.g., new inputs, new emissions flows, non-present in baseline), it should be added to the list of the processes constitutive of the EF.

→ **The Intervention requires numerous process changes in nature and quantities utilised.** The values are different from initial baseline EF as the Intervention unlocks a great level of intel regarding sustainability data (see next section). For every data level available, there will be a possible EAP calculated.

The basic equation to calculate the total product emissions according to an example process map should be:

Equation 3. Formula to calculate product emissions

$$TPE = EAP_{P1} + EAP_{P2} + EAP_{P3} + EAP_{P4} + EAP_{Pn}$$

or

$$TPE = \sum_{p=1}^{m} [Demand_p \cdot EF_p]$$

Where:

→ **TPE** = the total net emissions associated with producing a 1 kg of product
→ **EAP** = the total net emissions associated with the targeted process
→ **EF** = the emission factor associated with the targeted process
→ **Demand** = the process demand or the amount of input needed to execute the process for 1 kg of product (e.g., to produce 1 kg of bread, 1.1 kg of flour is needed)
→ **P1** → **Pn** are the processes to be considered to verifiably establish mitigation outcomes

Step 2. Identify levels of data available and apply data hierarchy

After understanding what the relevant processes are, different levels or sources of data should be identified and prioritised.

There are three distinct levels of data:

1. **Default data**: This data usually comes from ISO 14064-2-compatible methodologies or LCA databases (e.g., IEA, Agribalyse, DEFRA, GaBi, Ecoinvent). They are used in inventories and in GHG models as accessible information to assess emission levels.
2. **Company-specific data:** These are datasets created for the organisation needs (corporate accounting and product level reporting, among others) to better represent the typology of operating units and do not fully answer the data needs for Interventions.
3. **Project data**: This data is generally more granular and focuses on the measurement of GHG mitigation outcomes at the level of the Intervention. It encompasses:
   a. Baseline, or the Intervention-affected data for the baseline scenario
   b. Post-Intervention, or the post-Intervention EF data at the affected impact layer

Project-level datasets should be built following requirements from the selected GHG methodology. This guarantees that the full life cycle of the Intervention is covered for completeness and conservativeness, and guarantees adequate representativeness of the dataset. The project-level dataset should overwrite impact organisation default data and default data in organisational GHG inventory exercises.

Table 5. Example of table for data points per level and process for Intervention

Quality level (-) → Quality level (+)

Process/data level	(1) Default data (D)	(2) Company-specific data (D)	(3a) Project data baseline (B)	(3b) Project data post-Intervention (P)
Process 1	D_1	C_1	B_1	P_1
Process 2	D_2	C_2	B_2	P_2
Process 3	D_3	C_3	B_3	P_3
...	...	...	...	...
Process *n*	D_n	C_n	B_n	P_n

The quality of the data used for GHG modelling is defined as the multi-dimensional representativeness of it for a given situation. An excellent driver to assess the quality of that data is presented in Equation 1, and should be completed with other key elements (e.g., conservativeness assessment among others). The highest quality level of data in term of representativeness is (3b) project data post-Intervention, followed by (3a) project data baseline, (2) company-specific data, and (1) default data.

Step 3. Use process substitution

Once the sources of information are validated, the *process* substitution is conducted. This substitution will aim to use the highest data level possible. The exercise has two positive outcomes:

→ **Reductions and/or removal reporting and impact unit creation**, so the impact units can be transferred and traded with other value chain players. To ensure consistency and focus on the value chain activities, this calculation should consider only the processes included in a "*cradle to gate*" calculation. This approach considers first (1) default data, and then (3) project data baseline. This generates two models:

→ Baseline emissions, where the reference EF data is completed with baseline-specific data for impact layers affected by the Intervention, i.e., the model mapping receives more specific data by order of priority: first the (3a) project baseline data, then (2) company-specific data, then (1) default data, which translates into:

Equation 4. Calculation of baseline emissions for impact unit creation

$$TPE_{BL} = \sum_{p=1}^{m} \left[Demand_p(max(Level_1, \dots, Level_n)) \cdot EF_p \right]$$

Where:

- TPE_{BL} = the total net baseline emissions associated with producing a 1 kg of product (without Intervention)
- $Demand_p$ = the process demand needed for the targeted process
- EF_P = the emission factor for the targeted process
- $Level_1 \rightarrow Level_n$ = the quality level of sustainability data, which includes the data levels in the table below:

Table 6. Data levels used for impact unit creation

Process/data level	(1) Default data (D)	(2) Company-specific data)	(3a) Project data baseline (B)
Process 1	D_1	C_1	B_1
...	...	...	...
Process *n*	D_n	C_n	B_n

The use of secondary default data is limited to processes (parts of the EF) that are not calculated through a methodology that requires primary data, and are not impacted by the Intervention. This is illustrated in Example 3.

→ Post-Intervention emissions, which are derived from post-Intervention data for the affected impact layers. The modelling is conducted by mapping first the (1) LCA default data and (2) company-specific data, and then substituting, when possible, with (3b) project post-Intervention data.

Equation 5. Calculation of post-Intervention emissions for impact unit creation

$$TPE_{Pi} = \sum_{p=1}^{m} \left[Demand_p(max(Level_1, \dots, Level_n)) \cdot EF_p \right]$$

Where:

- TPE_{Pi} = the total net emissions associated with producing a 1 kg of product after the Intervention is implemented
- $Demand_p$ = the process demand needed for the targeted process
- EF_P = the emission factor for the targeted process
- $Level_1 \rightarrow Level_n$ = the quality level of sustainability data, which includes the data levels in the table below:

Table 7. Data levels used to calculate the emissions after Intervention for impact unit creation

Process/data level	(1) Default data (D)	(2) Company-specific data (C)	(3b) Project data post-Intervention (P)
Process 1	D_1	C_1	P_1
...	...	...	...
Process *n*	D_n	C_n	P_n

The use of secondary default data is hence limited to parts of the EF that are not impacted by the Intervention. Such use is also limited by standard GHG quantification methodologies' requirements that disqualify average-based approaches (e.g., for baseline setting). This is illustrated in Example 3.

→ **Improving inventories and claims reporting**, so organisations can communicate their impact and progress towards targets. This assumes that the use of post-Intervention data is limited to reporting completed in a time frame compatible with Intervention onset. Another key requirement is the assurance that mitigation outcomes derived from the Intervention are not comprised in baseline emission levels. Under these conditions, this approach allows for integrating all processes in the framework (beyond the "*cradle to gate*" boundaries), and considers (1) LCA default data, (2) company-specific or cli-

ent default data, and then (3b) project post-Intervention data. This also generates two models:

→ **Organisational default data,** which refers to the default data used by the organisation in determining its organisational footprint. The interfacing exercise starts with the interfacing (including mapping) of the (1) default data and the (2) company-specific data for the targeted processes.

Equation 6. Calculation of organisation default emissions for reporting

$$TPE_D = \sum_{p=1}^{m} [Demand_p(max(Level_1, \dots, Level_n)) \cdot EF_p]$$

Where:

- TPE_D = the total net emissions associated with producing a 1 kg of product that are default to the organisation
- $Demand_p$ = the process demand needed for the targeted process
- EF_p = the emission factor for the targeted process
- $Level_1 \rightarrow Level_n$ = the quality level of sustainability data, which includes the data levels in the table below:

Table 8. Data levels used to calculate the organisational default data for reporting

Process/data level	(1) Default data (D)	(2) Company-specific data (C)
Process 1	D_1	C_1
...	...	...
Process n	D_n	C_n

→ **Post-Intervention for the organisation**, which represents the post-Intervention client reporting, only valid for the affected amount. The model is created by using the (1) LCA default data, then substituting with (2) company-specific or client default data where possible, and finally assigning the (3b) project post-Intervention data where possible.

Equation 7. Calculation of post-Intervention emissions for reporting

$$TPE_{PiO} = \sum_{p=1}^{m} [Demand_p(max(Level_1, \dots, Level_n)) \cdot EF_p]$$

Where:

- TPE_{PiO} = the total net emissions associated with producing a 1 kg of product that are default to the organisation
- $Demand_p$ = the process demand needed for the targeted process
- EF_p = the emission factor for the targeted process
- $Level_1 \rightarrow Level_n$ = the quality level of sustainability data, which includes the data levels in the table below:

Table 9. Data levels used to calculate the post-Intervention data for reporting

Process/data level	(1) Default data (D)	(2) Company-specific data (C)	(3b) Project data post-Intervention (P)
Process 1	D_1	C_1	P_1
...	...	...	...
Process *n*	D_n	C_n	P_n

The new datasets generated should only be applied to quantities of goods and services identified in the inventory exercise as being impacted by the Intervention and adequately documented.

Example 3. **Company improving inventory data**

Company A is collecting the information that must be integrated to properly represent baseline and target GHG emissions profiles while implementing a reduction and/or removal initiative. The Company is working on an Intervention that modifies processes 2 and 3, and adds process 5. For the exercise, the company focuses on:

→ Default data (LCA databases e.g., GaBi, Ecoinvent) is available for processes 1-4 and 6-7 and is qualified by the auditor during validation and verification of the Intervention.

→ Default data is available for process 5, qualified by the auditor during validation and verification.

→ Company A can cover processes 2, 4, and 6 partially with primary data for most material sub-processes. This information is used in annual reporting and updated accordingly.

Table 10. Data levels available for example

Input Data	(1) Default data (D)	(2) Company-specific data (O)	(3a) Project data baseline (B)	(3b) Project data post-Intervention (P)
Process 1	D_1	0	0	0
Process 2	D_2	C_2	B_2	P_2
Process 3	D_3	0	B_3	P_3
Process 4	D_4	C_4	0	0
Process 5	D_5	0	0	P_5
Process 6	D_6	C_6	0	0
Process 7	D_7	0	0	0

Company A seeks recognition for the mitigation outcomes generated by the Intervention, and therefore aims at generating Impact Units (unitising impact so it can be traced and claimed). For that, Company A uses the (1) default data to cover unchanged processes. Client default, project baseline data, and project data post-Intervention are used to quantify mitigation outcomes and make the case for sustainability data that was created for the evaluation of the Intervention.

Table 11. Data levels used to calculate impact units in example

Impact unit Creation	(3a) Project data baseline (B)	(3b) Project data post-Intervention (P)
Process 1	B_1	P_1
Process 2	B_2	P_2
Process 3	B_3	P_3
Process 4	B_4	P_4
Process 5	0	P_5
Process 6	0	0
Process 7	0	0

Company A also aims to create its yearly report and claim progress towards its reduction target. For that, Company A uses default data, organisational data, and post-Intervention project data.

Table 12. Data levels used to produce an EF for reporting and claims in the example that the quantity of good that has been proven to be impacted can be adequately traced back to the Intervention Supply Shed.

Reporting	(1) Default data (D) and (2) Company-specific data (C)	(3b) Project data post-Intervention (P)
Process 1	B_1	P_1
Process 2	B_2	P_2
Process 3	B_3	P_3
Process 4	B_4	P_4
Process 5	0	P_5
Process 6	B_6	P_6
Process 7	B_7	P_7

We also include an example of a simplified process.

Example 4.

Improving the data for producing 1 kg of bread

In this example we focus on a simplified process through which Company C produces bread using three inputs: flour, an oven, and water. Company C aims to calculate the net emissions for 1 kg of bread produced. The company already invested to establish high-efficiency use of resources (3a) when compared to what most companies do (default LCA, average for considered market). Beyond this, the company decides to implement an Intervention where it uses a low-carbon flour and more efficient ovens that speed up the baking time. The data collected for 1 kg of bread is as follow:

Table 13. Data levels available for example

Process/EF, Data level	EF (kgCO2eq/unit)	(1) Default LCA data	(3a) Baseline data data	(3b) Post-Intervention data
P1 Flour	0.5	1.1 kg	1 kg	0
P2 Flour (low CO2)	0.4	0	0	1 kg
P3 Oven use	0.25	1 hour	0	0
P4 Oven use (low CO2)	0.2	0	1 hour	0.8 hour
P5 Water	0.01	1 litre	∅	1

To calculate the baseline data for the Intervention, Company C defines data values (3a).

Table 14. Data levels used to calculate baseline emissions

Process/EF, Data level	EF (kgCO2eq/unit)	Process demand to calculate baseline	TPE_D (kgCO2eq)
P1 Flour	0.5	1 kg	0.5
P2 Flour (low CO2)	0.4	0	0
P3 Oven use	0.25	0	0
P4 Oven use (low CO2)	0.2	1 hour	0.2
P5 Water	0.01	1 litre	0.01
		Total	0.71

To calculate the post-Intervention data, Company C defines data values (3b).

Table 15. Data levels used to calculate post Intervention emissions

Process/EF, Data level	EF (kgCO2eq/unit)	Process demand to calculate post-Intervention	TPE_{PIO}(kgCO2eq)
P1 Flour	0.5	0	0
P2 Flour (low CO2)	0.4	1 kg	0.4
P3 Oven use	0.25	0	0
P4 Oven use (low CO2)	0.2	0.8 hour	0.16
P5 Water	0.01	1 litre	0.01
		Total	0.57

Based on these numbers, Company C can calculate the amount of impact unit that can be verified, in order to then claim through integration in their inventory.

Considering Company C produces 10 tonnes of bread per year, its annual impact is calculated as:
TPE_D - TPE_{PIO} = TPE
0.71 – 0.57 = 0.14 kgCO2eq/kg of bread produced
0.14 x 10,000 = 14 tonCO2eq

5.3 Cases when interfacing can be implemented

Given the potential challenges that improving data carries, interfacing should be especially considered in the following situations:

→ Learning from Interventions and applying improved data to similar Interventions
→ Better understanding the impact of Supply Sheds for strategic decision making
→ Managing risks in the supply chain and operations

For future exploration:

- **How to build upon datasets with different geographical and temporal scopes? (E.g., annual facility data and aggregated supply chain data.)**
- **What are the implications from the leading GHG accounting and reporting frameworks for the CoC?**

6.

Monitoring, Reporting, and Verification (MRV) for interventions at supply chain-level

This chapter is intended to provide a vision of how Monitoring, Reporting and Verification (MRV) will evolve, especially with Supply Sheds. Implementation principles are included to provide practitioners with concrete aspects to safeguard in new strategies.

Challenge identified:
Despite MRV being a key part of GHG accounting practices, operational guidance is lacking due to its intrinsic specificity to Intervention types. As a diversity of approaches become available in the market, the most fundamental implementation principles are needed to identify better solutions.

Relevance:
Being able to make better choices when it comes to MRV is essential, as implementation costs are often a barrier to scale. This is especially important for the Supply Shed approach as Supply Sheds aim to catalyse landscape-level impact, which implies smart MRV decisions are needed to measure what matters effectively.

6.1 Future of monitoring

An adequate MRV system is the keystone to credible quantification and accounting of Intervention benefits. The system supports the coupling of material and information fluxes to create verifiable datasets. These datasets must support the validation and verification of the credibility of mitigation outcomes, including the credibility of their allocation within product systems and attribution to various economic actors in the value chain. In other words, the MRV system must deliver outputs upon which a professional auditor can formulate a fact-based opinion.

Pilots to monitor Intervention at the Supply Shed are being executed at the time of writing. The pilots reveal that:

- → Current MRV systems focus on Intervention-level data and are then to be complemented with default eco-region information for compatibility with corporate GHG emission inventories.
- → The main challenge is knowing *what to monitor, at what scale, how frequently, and in a financially feasible manner* to keep the data sufficiently representative.
- → In terms of *how to monitor*, and in light of continuous technological developments, identification of peer-reviewed technology (from high impact factor publications) recognised by GHG accounting experts and sectoral experts is also becoming increasingly diverse.
- → The costs and complexity of legacy MRV operating systems constitute a significant barrier to scale and a barrier to accelerating climate action (e.g., lack of automation).

The Intervention accounting leveraging a Supply Shed approach is an opportunity to unlock by contributing to investment into improved and cost-effective monitoring. It also provides an opportunity to co-develop more accurate data/MRV systems with value chain partners and Supply Shed partners.

Box 8. **Outlook for MRV: “as is” versus “to be”**

Current Intervention-based monitoring focuses on collecting primary data on single (isolated) cases or groups (a bottom-up approach). The Supply Shed approach aims to complement the information obtained at Intervention level (again, bottom up) with additional landscape information obtained through modelling and satellite technologies (top down).

In the future, Supply Shed approaches can help to build up the capabilities of the suppliers in a specific supply chain, eventually moving the entire sourcing footprint towards “perfect data”, or ultimately defining the sourcing footprint for the organisation. However, and perhaps the most interesting/desired scenario, is to amplify impact in the sourcing region, which entails catalysing action and Interventions based on a “good-enough” level of information. In this second scenario, Supply Shed models and data can provide meaningful information for monitoring and decision making without necessarily having perfect information for all suppliers in the Shed.

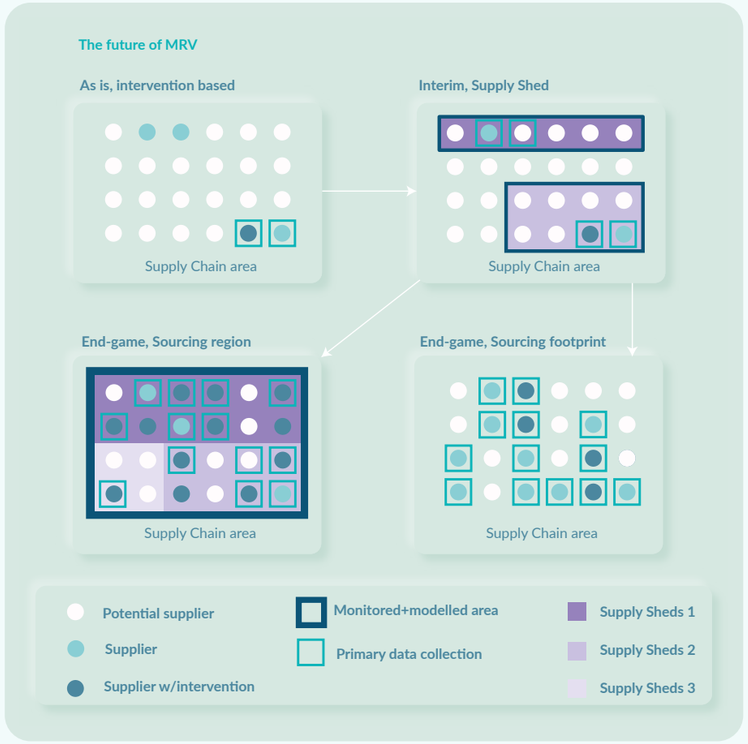

Figure 17. Scenarios for MRV

6.2 Implementation principles for MRV

Monitoring practices are likely to evolve at an accelerated pace: hybrid systems combining digital and field-level monitoring will increase accuracy if correctly implemented, while scalability needs to be ensured. Since there are many uncertainties in this future, the focus of this document is on implementation principles that will support choices when designing MRV strategies or working with service providers. These are as follows:

- → **Credibility**: MRV plans and methods must be in alignment and in compliance with main Carbon Standards. Examples of criteria that re-enforce this principle include fit of the quantification approach, uncertainty in the data, models used, replicability, and data protection.
- → **Scalability**: The MRV strategy needs to cater for the operational complexity, and specifically for digital MRV frameworks, the strategy must include software architecture and data accessibility.
- → **Viability**: The MRV strategy should be cost effective by allowing economies of scale and usability for all parties.
- → **Applicability**: The MRV strategy should ensure compliance with data requirements from key standards, and align with the organisation’s strategic priorities.
- → **Agility**: The MRV strategy should ensure adaptability and continuous improvement.

Example 5. **Designing a MRV plan for the future**

Company A is designing the MRV strategy to fit its supply chain. The approach of the company considers three main action lines:

- → Identifying and leveraging operational primary data sources (e.g., procurement function mandatory reporting), ranging from information collected by farmers out in the fields to delivery bills.
- → Using third-party empirical data sources (remote/satellite imagery, regional governmental inventory efforts) for GHG modelling and tracking farm-level EFs at the Supply Shed scale.
- → Using parts of the MRV system for a given Intervention to host other Intervention types in the future.

To implement this, the MRV strategy contemplates the following points:

- → Adherence to established and upcoming principles and criteria.
- → Accounting for removals is conducted in terms of measurement, modelling, and monitoring with explicit sources of data, and uncertainty is estimated quantitatively for these removals.
- → Net carbon stock losses are reported as reversals, and although long-term contracts cannot be enforced with farmers beyond five years, they are considered in the risk management strategy.
- → Methodologies and technologies outputs are replicable for audits.
- → Traceability is ensured to the Interventions, and the relation between the Supply Shed and these Interventions is proven and documented.
- → Land-use change and land management emission reductions are reported separately.
- → There is reasonable due diligence to justify that no double claiming occurs, that emissions are not overrated, and that impact is tracked.

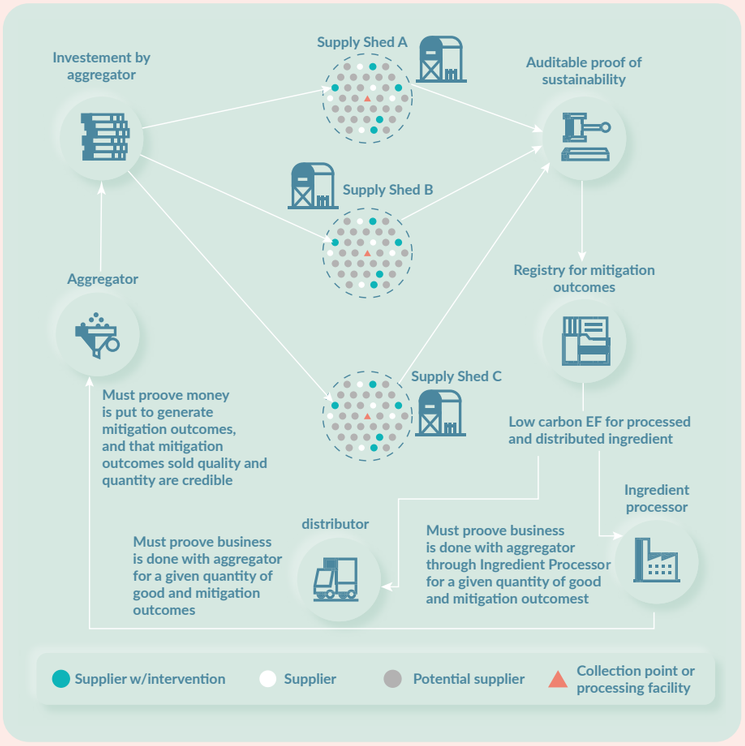

Figure 18. Case where the aggregator is the Intervention representative and collaborates with the ingredient processor and distributor

This case illustrates how a food **ingredient processor** does not need perfect physical traceability to farmers in Supply Shed A, B, or C to be able to claim mitigation outcomes **as long as:**

- → **The aggregator** conducts continuous business with Supply Sheds A, B, and C, and payment for mitigation outcomes is proven on a yearly basis.

- → **The ingredient processor** conducts business with the **aggregator** with guaranty of origin for sourcing.
- → **A third-party verifier** can complete an audit on total mitigation outcomes and quantity of goods.

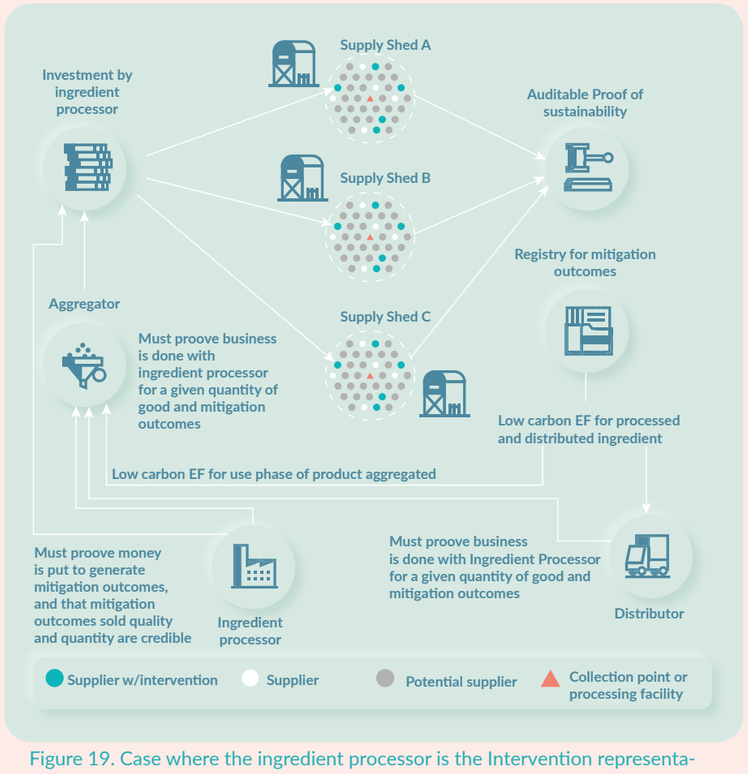

Figure 19. Case where the ingredient processor is the Intervention representative and collaborates with the aggregator and distributor

This case illustrates how a **distributor** does not need perfect physical traceability to processing plants in Supply Sheds A, B, or C to be able to claim mitigation outcomes **as long as:**

- → **The ingredient processor** conducts continuous business with Supply Sheds A, B, and C and payment for mitigation outcomes is proven on a yearly basis.
- → **The distributor** conducts business with the **ingredient processor** with guaranty of origin for sourcing.
- → **A third-party verifier** can complete an audit on total mitigation outcomes and quantity of goods.

7. >

Assurance principles for market-based approach

This chapter discusses why assurance is needed, the value of third-party assurance and its role in accounting, claiming, and reporting, in particular for Supply Sheds. The aim of the chapter is to provide practitioners with principles to safeguard, especially when developing assurance systems, and to convey ideas of how assurance can be implemented efficiently in the future.

Challenge identified:
Assurance can be seen as a hurdle in scaling up impact as it requires investment, and there is currently no perceived harmonised approach to it for GHG accounting. Basic principles for assurance are needed to guide the implementation of assurance systems consistently and to avoid over-quality in assurance systems.

Relevance:
Assurance, and specifically third-party assurance, is critical for ensuring the credibility of claims, and is required by GHG guidance. This is applicable for Intervention accounting. Having a vision for how these assurance systems need to be leveraged is important for their effective establishment.

7.1 Assurance in accounting, claiming, and reporting

Obtaining assurance on inventory and its improvements is valuable for reporting companies and stakeholders. There are multiple ways to build up assurance in a system, yet only a few can deliver trust and impact at scale. The different approaches are intended to reinforce objectivity and impartiality in the assurance assessment, while allowing for progression and diverse levels of assurance.

However, guidance for organisational GHG accounting offers limited information on the levels of assurance that should be provided by practitioners. Furthermore, mainstream GHG Intervention programmes aimed at generating reduction and/or removals are already designed and implemented far earlier than the present effort to gather these potential requirements.

Validation and verification of the mitigation outcomes and their attribution to goods produced within a Supply Shed contribute to the continuous improvement for these legacy programmes. We trust that organisations can define a clear, transparent, and auditable set of requirements that outline how an Intervention and the respective Supply Shed is to be assessed, how any attribution is to be verified, and then to build capacity to drive change and maximise impact per unit of investment. This should be done using intermediary levels of recognition for claims as investments are made to unlock climate action at scale.

Box 9. **Potential levels of assurance required for Intervention accounting towards Net Zero**

Product Environmental Footprint Category Rules Guidance (PEFCR) Version 6.3-May 2018
The verification of the EF report shall be carried out by randomly checking enough information to provide reasonable assurance that the EF report fulfils all the conditions listed in Section 8 of the PEFCR Guidance.

Suggestions for updating the Organisation Environmental Footprint (OEF) method 2019
The validation of the OEF report shall be carried out by checking enough information to provide reasonable assurance that the OEF report fulfils all the conditions listed in Section 8.4.1 of the OEF method 2019

Discussion note – MRV principles for the EU Carbon Border Adjustment Mechanism (CBAM), 27 September 2022
The monitoring methodology and the data management agreement must allow the verifier to achieve reasonable assurance on the emissions report, i.e., the data must be able to endure intensive tests. Data shall be free from material misstatements and avoid bias.

GHGP Land Sector and Removals Guidance Draft Part 1
It is not appropriate to provide only a limited level of assurance if a programme includes removals in the context of a net GHG target. In such cases, reasonable assurance is recommended.

ISO/CD 14068: 2022 Carbon Neutrality Draft
Relevant information is disclosed publicly to enable stakeholders to understand all statements concerning a commitment to, and achievement of, carbon neutrality and to make decisions with reasonable confidence.

CDP Forests 2022 Reporting Guidance
CDP's approach to reporting on commodity-driven deforestation risk. Accuracy: Ensure the quantification of commodity production, trade and/or use is sufficiently accurate to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

ICVCM Public Consultation Final Compendium
The carbon-crediting programme shall define a performance system to monitor the effective implementation of access and benefit sharing including third-party verification. As framed in the Criterion 6.1: Minimum information requirements, "The carbon-crediting program shall make the following information available in electronic format > All necessary information to enable third parties to replicate the emission reduction calculations (including baseline quantification) and assess the social and environmental impacts of the activity".

Note

At the time of writing, SBTi released a request for proposals for 2023 to "Determine the data assurance requirements" including "levels and periodicity of assurance and/or verification requirements for the SBTi accountability framework," considering "relevant voluntary and regulatory disclosure frameworks."

7.2 Potential principles for developing an approach on assurance

Assurance systems or strategies are the set of instruments and processes that organisations use to build credibility around their claims and the value they deliver to their customers.

Organisations must build an assurance system that is feasible, scalable, cost effective, and one which can be used to assess a portfolio of projects. For this, implementation principles of assurance are proposed:

- → **Impartial**: Must define which points a third party can verify and provide a reasonable level of assurance to enhance credibility, guaranteeing reliability and truthfulness of outputs.
- → **Flexible**: Must allow for different levels of assurance, recognising that Interventions in an organisation's portfolio will present different maturity profiles. This means that the system must allow third-party limited and reasonable levels[14] of assurance depending on the type of claim.
- → **User-centric:** Must serve the organisation and ultimate user (i.e., be understandable to stakeholders who will receive the claims). This means that it must help the organisation that is verifying the results to cover its objectives (e.g., contribution to SBTi/ISO Net Zero), and provide useful information on performance and/or compliance in a clear way to consumers willing to invest in goods and services that contribute to limiting climate change.
- → **Standardised:** Must offer tools and a set up that is harmonised with other assurance frameworks and standards, to ensure consistency and convergence. The ultimate goal is to enable replicability and scalability in a cost-effective way.
- → **Actionable and improvement-oriented**: Implementation should be operationally and financially achievable for organisations, and the outcome of the assurance assessments must allow the organisation to manage risks.
- → **Progressive**: Must leverage on MRV, tracking systems, and further data from the company, and therefore it must continue to adapt to the needs of the supply chain and Supply Shed (e.g., improving traceability, reducing uncertainty). The system should also allow for incorporating new technologies. Furthermore, the system must recognise reliability of inputs and adapt accordingly, e.g., leverage the use of trusted data to simplify verification pathways and recognise uncertainty.

14 SustainCERT S.A. (2021). SustainCERT Verification Requirements for Value Chain Interventions (Version 0.9). Available upon request

Box 10. **Outlook for assurance systems: the case for coordinated action**

Current approaches for assurance are managed per organisation and per value chain. The coverage of multiple audits that provide assurance partially entails the same actors, methods, and tools on which they provide assurance. With such a fragmented effort, the implementation is likely to be redundant for some parties and the efficiency of co-investment undermined in the Supply Shed.

The outcome of this approach is resource intensive, and risks the possibility of double claiming due to the lack of a data-enabled centralised controlling actor. If the assurance system is designed for a Supply Shed in which various corporates are present and willing to collaborate, it offers efficiencies due to economies of scale, effectiveness as information can be constantly and multi-laterally checked, and more insights as the landscape can be assessed as a whole.

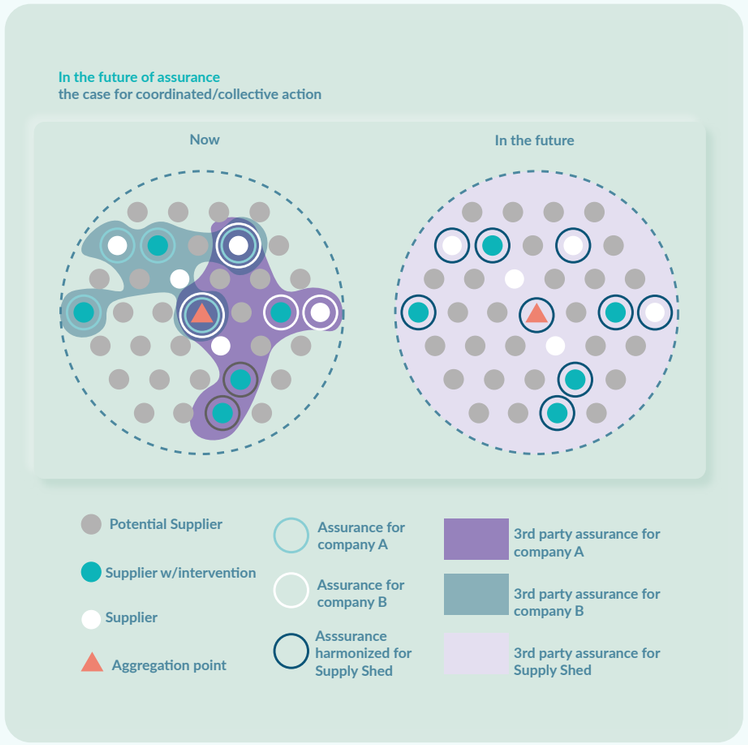

Figure 20. Vision for assurance in the future

Based on this potential scenario, the outlook of additional principles could include:

- → **Centrally coordinated**: The assurance system should be co-owned and implemented by a third party that offers a Supply Shed level approach.
- → **Beneficial to all investing actors:** The same level of assurance can be achieved for different companies at the same time

7.3 The value of third-party verification

In addition to third-party verification being recommended for GHG inventories and Interventions, there are also known benefits of assurance:

- → Increased confidence in data and conformity to standards which helps de-risk external or internal reporting of complex information and management plans.
- → Compliance with requirements specified by the GHGP, LSRG, and SBTi.
- → Opportunities to improved based on third-party feedback, with a holistic perspective and in-depth expertise.
- → Increased trust and transparency in supply chains, as a third party can manage sensitive information with confidentiality.
- → Specialists in assurance have a broad experience of interpreting standards and applying them consistently in different circumstances. This ability is rarely available with first-party assurance, where expertise is typically focused on the business.

Example 6. **Real world example for value in assurance systems –Evidence from literature**

- → "...evidence shows that firms with greater environmental disclosures, and those who externally assure their corporate social responsibility reports, decrease their COE [cost of equity]. Our study expands the literature regarding carbon emissions and its relation with firms' COE from an emerging market perspective covering a multi-country sample, with findings that confirm that higher emitters are penalised in terms of COE." (Garzón-Jiménez and Zorio-Grima, 2021).15
- → "The **assurance of CSR reports gives higher credibility to those reports as an external verification process** especially in countries with great stakeholder demand for sustainable practices. The negative relation between COE and CSR assurance has been evidenced by existing research. For example, Casey and Grenier conclude that the voluntary assurance of CSR reports reduces COE and the reduction increments when the assurer is an accountancy firm. Moreover, Martinez-Ferrero and Garcia-Sanchez evidence lower COE when the assurance provider is a "Big " audit firm. Finally, Weber analyses the assurance practice and Global Reporting Initiative (GRI) reporting levels, concluding that poor CSR performers reporting at high GRI levels decrease COE when their CSR report is assured." (Garzón-Jiménez and Zorio-Grima 2021)
- → "Empirical results from the study show that the **external carbon assurance contributes an amount of 10% to the market value of the firms**, as compared to an amount of 5% and 4% for the carbon targets and the carbon communication, respectively." (Shen et al. 2020, 549)16
- → "Specifically, the **external assurance of the carbon emissions possesses a higher market value than the carbon targets**, and the carbon communication. It implies that corporations are not only supposed to reduce carbon emissions, but they also need to maintain the reliability of the emission values by using third-party assurance to keep the confidence of the outside stakeholders intact." (Shen et al. 2020, 558)

15 Garzón-Jiménez, Renato, & Ana Zorio-Grima. (2021). Effects of Carbon Emissions, Environmental Disclosures and CSR Assurance on Cost of Equity in Emerging Markets. *Sustainability* 13, no. 2: 696. URL: https://doi.org/10.3390/su13020696

16 Shen, Yijuan, Zhi-Wei Su, Guanhua Huang, Fahad Khalid, Muhammad Bilal Farooq, & Rabia Akram. (2020). Firm Market Value Relevance of Carbon Reduction Targets, External Carbon Assurance and Carbon Communication. *Carbon Management* 11 (6): 549–63. URL: https://doi.org/10.1080/17583004.2020.1833370.

8.

Scaling up current interventions through collective action

The purpose of this section is to provide an overview of how collective action and finance are related to the Supply Shed, to inspire companies and governments to take action towards scaling up current Interventions.

Challenge identified:
This document compiles approaches that aim to accelerate impact and sector decarbonisation by enabling claims in a context of “imperfect” traceability and dynamic value chains. However, to scale up impact efficiently and radically transform sectoral GHG emissions, a few sparse Interventions will not do — collective action is needed. By enabling the coordination and mobilisation of multiple stakeholders, the Supply Shed approach can be leveraged effectively. To deliver on the commitments driven by collective action, financial institutions must be brought to understand how key concepts such as Supply Sheds can unlock mitigation outcomes and robust claims with the right transparency and assurance levels.

Relevance:
By using consensus to establish the set of best practices for collective action, front-runners outline the roadmap to unlock finance at scale and maximise outcomes. This can also inspire ideas on potential mechanisms and solutions which have been successful in other sustainable development areas.

8.1 From industry best-in-class to collective action

Companies actively working on delivering outcomes that match goals set by their climate strategies follow good practice by prioritising actions with a mitigation hierarchy.[17] This framework establishes that organisations should:

- → **Reduce and remove emissions** in their value chains by making emitting activities more efficient and lowering their emissions intensity, for example through more efficient processing and transport networks.
- → **Take responsibility** for residual emissions. This can be done **through actions to help reduce and remove emissions outside of their value chains by cooperating with engaged organisations (corporates, governments)** to support the cessation of emitting activities, such as the stopping of loss and conversion events in land management

This logic discourages companies from choosing to offset rather than avoid or reduce emissions, with the driving principle being that companies should actively act and take responsibility for their emissions. What this framework also implies is that once companies have explored all means of directly influencing or reducing their emissions, they can then employ *enabling actions* that will contribute to the ecosystem in order to scale impact.

Furthermore, the Corporate Climate Mitigation Blueprint[18] proposes that for companies to take responsibility for remaining emissions, they should quantify the financial commitment by pricing or assigning a value for these emissions, and invest that financial commitment into action for climate and nature impact. Potential actions include:

- → Investing in renewable energy power, alternative fuels and more sustainable raw materials to further reduce emissions.
- → Unlocking climate solutions through climate innovation and landscape finance. Climate innovation refers to innovative technologies and new business models that are key for mitigation efforts, and landscape finance refers to nature-based solutions that address, for example, major drivers of deforestation.
- → Investing in carbon credits/offset through quality carbon credits/mitigation outcomes.

These investments would ultimately enable systemic impact, by helping advance action and innovation, and increasing the demand for high quality carbon credits. To support these actions, and for organisations to truly drive a holistic climate strategy, the Blueprint emphasises the need to collaborate with peers and other stakeholders, and this is possible through organised collective action.

17 Gold Standard. (2022). *Accounting & reporting the emissions of certified commodities: Introductory guidance. Version 1.0.* URL:https://www.goldstandard.org/sites/default/files/documents/accounting_opening_guide_-_certificate_holders_and_applicants_final.pdf

18 WWF. (2020). *Credibility and Climate Action: A Corporate Blueprint*. URL: https://wwf.panda.org/wwf_news/?1172766/Blueprint-Corporate-Action-Climate-Nature

8.2 Collective action

The Supply Shed is an approach that would ultimately affect multiple stakeholders: not only the suppliers in the group and their value chain partners, but also different landscape actors. Furthermore, action taken by individual parties (e.g., private farmers, forest owners, public agencies) is likely to be successful in meeting individual sustainable resource management objectives without the cooperation of others.[19] Collective action is needed to effectively organise and address this complexity in a truly sustainable way.

8.2.1 What is collective action?

Collective action occurs when more than one individual is required to contribute to an effort in order to achieve an outcome.[20] Collective action refers to collaborative or cooperative efforts undertaken by a group of individuals or organisations (usually multistakeholder), governed by self-interest, and aimed at achieving a common vision.

In the Food and Agriculture space, collective action is often coordinated by multistakeholder platforms and Industry Organisations. While multistakeholder platforms often represent a complete sector on a regional or global scale (e.g., Global Coffee Platform, World Cocoa Organisation), Industry Organisations focus on a specific context, and could represent a specific group of the value chain that is horizontally or vertically integrated (e.g., American Dairy Association, or the Dairy Farmers of America).

8.2.2 Why collective action is needed?

- → To develop and align the different individuals/organisations around a common vision.
- → To convene a group of organisations and speak with one voice to other stakeholders. This supports consistent messaging when advocating for the sector.
- → To enable effective use of resources as a result of coordinated actions.
- → To achieve or maintain consistent progress in a sector, by creating a common framework for accountability and advocating for transparency and disclosure.

8.2.3 Functions of collective action

- → **Knowledge development and innovation**, by supporting research and innovation for a specific industry, e.g., climate innovation.
- → **Coordinate and mobilise,** creating the fora for stakeholders to coordinate efforts.
- → **Joint implementation** (including MRV), by effectively using the pool of resources from the different stakeholders to implement actions.
- → **Facilitate and/or provide funding/finance**. This can be done in many ways, for example, either by funding enabling Interventions from the pool of resources, leveraging this to tap into blended finance mechanisms, etc.
- → **Communicate and influence**, by creating communication products that can be shared to broader audiences, driving dialogue, and informing and/or influencing policy.
- → **Create accountability** towards a common vision, by enabling the collective commitments, disclosure of progress, and common frameworks for reporting.

19 Scherr, Sara et.al. (2015). *The Little Sustainable Landscapes Book: Achieving sustainable development through integrated landscape management*. URL: https://globalcanopy.org/insights/publication/the-little-sustainable-landscapes-book/

20 Ostrom, Elinor. (2004). Understanding collective action. *International Food Policy Research Institute (IFPRI), 2020 vision briefs*. URL: https://www.ifpri.org/publication/understanding-collective-action

8.2.4 Process for collective action

1. **Develop and align to a common vision.** Organisations must identify common interest and develop the vision for the long term. Together, they will also define the roadmap to get there, and the way in which they will collaborate.
2. **Establish commitments,** where every party aligns its own strategy and establishes how their own commitments and goals will contribute to achieve the common vision.
3. **Develop a framework for action and impact.** This implies that the different parties must develop the mechanisms to collaborate in a precompetitive way, as well as the frameworks to monitor progress towards that vision.
4. **Implement actions.** Depending on the way the collaboration has been set up, this implementation can be joint or individual, e.g., a group of companies agreeing on a basic package of actions for Interventions and then every company implementing with their own suppliers, or a group of companies funding a third party to implement the similar Interventions across a group of common suppliers.
5. **Assess progress and impact.** Once actions to achieve the vision have been implemented, progress and impact must be assessed and reported. This can be done collectively or individually, e.g., a group of companies implementing the same framework or standard to measure progress, or a third party that is contracted by multiple companies to assess progress in a landscape.

8.2.5 Supply Shed as the foundation of collective action

The Supply Shed concept was introduced to deal with cases of non-traceability or an inability to segregate purchased goods. If traceability is available to a certain level, for example a sourcing area, then an equivalent scale of collective action could negate the need for more complex assignment of benefit. The *average EF* would be addressed through available traceability and could be reported in line with standard GHGP requirements. Having said that, it is improbable that sourcing area (or larger) collective, comprehensive and robust efforts can be established and immediately in operation without tools to test and scale. Based on the requirements described for the Supply Shed (see Chapter 3), the boundaries for a region that can be consistently accounted for and reported on would be defined. While aggregators will source from the Supply Shed and sell this production to processors or brands, these brands could act on two levels on the Supply Shed:

→ Directly investing in Interventions to reduce/remove Scope 3 emissions. For companies to be able to claim this impact, attribution needs to be supported by evidence.
→ Investing in and supporting collective action. This collective action can be focused on different functions, from acting on *enabling Interventions* (e.g., innovation projects, coordination) all the way to facilitating individual action (e.g., jointly implementing Interventions across the Shed).

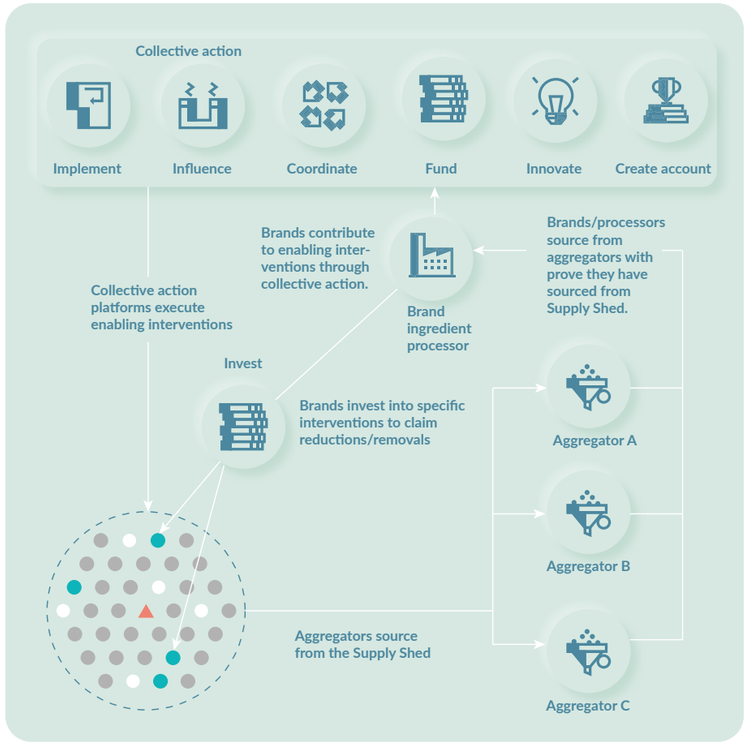

Figure 21. Collective action and Supply Sheds

For truly holistic and sustainable impact, companies working on climate action must balance both individual and collective action. Even though enabling Interventions might not result into an attributable claim since the impact achieved is indirect, as argued in Section 8.1, these efforts represent a way in which companies can take responsibility for emissions and are necessary for improving the likelihood of a successful outcome.

Furthermore, the functions that can be undertaken under collective action present the opportunity for companies to:

→ Coordinate action to ensure suppliers implement high quality effective Interventions.
→ Support collective action bodies to own and drive efforts to develop high quality databases.
→ Optimise resources by jointly implementing actions, e.g., MRV over a Supply Shed.
→ Leverage the common pool of resources to unlock further opportunities, e.g., supporting innovations, providing access to finance.
→ Speak with a common voice to local governments and stakeholders.
→ Execute enabling Interventions that are needed to create a sustainable ecosystem, e.g., creating the ecosystem for local service providers, executing capacity building programmes.
→ Connect climate strategies with other local sustainable development priorities, such as other environmental services, living income/wage.

Box 11. **Examples of collective action models in certified commodities that are compatible with a Supply Shed**

SourceUp or Verified Sourcing Areas (VSA). This model was developed by IDH, whereby in a producing region, a compact is made between public and private stakeholders at jurisdictional level. Any buyer or interested third party can assess if the region can contribute to its targets, and then join the compact, while MRV is conducted on a landscape level.

RSPO Jurisdictional Approach to certification. This model has been developed by the Roundtable on Sustainable Palm Oil to minimise the negative impacts of palm oil cultivation at jurisdictional scale through the implementation of sustainable certification schemes. It provides a framework for group certification, allocating authority to a jurisdictional entity, with a multistakeholder governing body. This governing body will ultimately implement an Internal Control System in the jurisdiction to facilitate full compliance to the standards, and associated monitoring and verification.

It is noted that further clarity, guidance and tools on how to attribute/assign beneficial claims to participants in collective action effort is needed. Gold Standard is looking at this across a range of use cases and will seek to explore these within the VCI.

8.3 Financing Supply Shed Interventions

In order to implement Interventions at scale in the Supply Shed, finance needs to be available for Intervention owners in the form of grants, loans and/or payment for ecosystem services (PES). In principle, there are different sources of finance for Interventions:

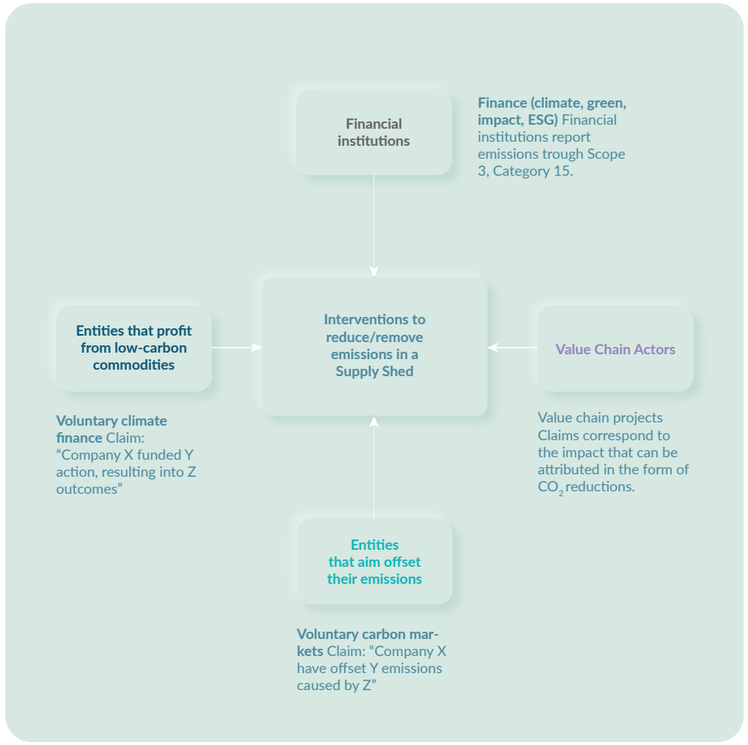

Figure 22. Sources of finance for Supply Shed Interventions

- → **Impact finance from financial institutions and investors**. Financial institutions and investors can be motivated to provide finance to low-carbon and carbon reduction projects due to their need to disclose their Scope 3, category 15 emissions. Impact finance implies the return is wider than just the financial return, with benefits for the lenders such as concessionary investments. The focus of financial institutions is on making loans available for Intervention owners.
- → **Voluntary Climate Finance mechanisms provided by third parties** (companies or other entities) looking to profit directly or indirectly from low-carbon commodities. The parties can make narrative claims for their contribution but cannot claim offsets from this support. As with Voluntary Carbon Markets, they can provide PES similar to carbon offsets. These third parties can also provide grants, especially when focused on landscape outcomes.
- → **Value chain partners**, which can directly benefit from both the availability of low-carbon commodities and the reductions within their own value chain. Provided the right mechanisms and safeguards, value chain partners could potentially claim impact of the reduction from their investments. This also can be in the form of grants and PES.
- → **Companies that aim to offset their emissions through Voluntary Carbon Markets**. This mechanism would result in carbon credits for Intervention owners. To use these mechanisms, project developers are required to issue credits, and these need to be part of a registry.

The type of financial support provided for these Interventions can be in the following forms:

- → **Loans** are instruments that provide an amount of money in the expectation that the principal amount is repaid, plus interest. These types of loans can serve multiple purposes, for example, to invest in replanting, new infrastructure, or even working capital, and can be provided to facilitate the implementation of the actions before the Intervention occurs. In green, climate, or impact finance, these loans could be drawn from sources that are specifically dedicated to projects that seek a positive outcome, and could include specific conditions to facilitate access.
- → **Grants** are instruments that fund projects that are expected to have a specific outcome, without the expectation of a financial return. Grants are often provided before the Intervention happens, and are often linked to a collective or landscape benefit, e.g., innovation projects or enabling Interventions.
- → **Payment for ecosystem services (PES)** compensates individuals for undertaking actions that increase the provision of ecosystem services such as water capture or carbon sequestration. PES are provided to the Intervention owner usually once the Intervention has occurred and impact can be measured and reported.
- → **Carbon credits or carbon offsets** are tradeable certificates or permits representing the right to emit a set amount of GHG emissions. These are also outcome-based, so the certificates are issued once the Intervention has occurred and its impact has been measured and verified.
- → **Other, including equity and guarantees and other instruments provided through blended finance.** A wide range of instruments can be provided through green/climate finance to facilitate access to capital in many ways, however the conditions vary.

8.3.1 Voluntary Climate Finance and value chain Interventions

Voluntary Climate Finance is a model wherein a company purchases a carbon credit to convey their support and causality of a beneficial impact, but no offsetting claim is made. This is similar to existing approaches for payments for ecosystem services or development impact bonds. This results in impact/outcome-based claims that establish "company X funded Y action, resulting into Z outcomes" and cannot be used for offsetting.[21]

Box 12.

Attribution vs. Contribution: What makes the case to claim impact in mitigation interventions?

In this document, *contribution* means that an organisation is positively influencing the operational system and is one of many factors that enable change. The concept of *attribution* refers to the act of accounting for the mitigation outcomes derived from positive change that the organisation(s) were proven to have contributed to.

While there is not a standardised way to establish and measure *attribution*, in climate-focused Interventions it is often established by supporting evidence such as the Intervention design document (IDD), contracts related to its implementation, and invoices or proof of payments. However, this attribution concretely relies on the *causality* that the action directly caused the desired outcomes, and the *counterfactual analysis* to understand what would have happened without the programme.

Causality is a key safeguard in Supply Shed Intervention accounting and reporting, and it is implicit in the "attributable working lands" safeguard for the sourcing region in the draft LSRG. According to the VCI 1.1 guidance, *causality* is the demonstration that an investment (or other equivalent action) of a company or group of companies acting collectively to take advantage of the Supply Shed is what caused the Intervention to happen. Furthermore, causality does not guarantee rights to be able to issue or retire carbon credits for other purposes from an Intervention. This depends on the requirements of the issuing body, which may not necessarily align directly with this definition.

8.3.2 Double claiming in financed supply Interventions

When both financial institutions or investors and companies intervene in an Intervention, it is generally admissible that both the company and the investor should report the emissions for this Intervention. This, with the understanding that investors would report under category 15 of Scope 3, while value chain companies could report under category 1. This would potentially entail an "acceptable" way of double claiming.

Furthermore, the other "acceptable" way of double claiming is when host countries for these Interventions report, as well as these investors and companies working in the Supply Shed. Unless carbon market instruments are involved, standards and stakeholders do not generally need to be concerned with their relationship with GHG accounting under the Paris Agreement, unless the host country itself is setting policy on this regard.[22]

21 & 22 Gold Standard. (2022). *Accounting & reporting the emissions of certified commodities: Introductory guidance. (Version 1.0).* URL:https://www.goldstandard.org/sites/default/files/documents/accounting_opening_guide_-_certificate_holders_and_applicants_final.pdf

Other mechanisms such as a registry would enable more transparent transfer and trade of claims in the event of co-investment and collaboration by value chain partners, and would avoid unacceptable double claiming in an Intervention. This would, for example, enable transferring impact claims for supply chain partners in case a company has invested in a stranded asset (due to a change in sourcing), reducing not only the risk of double claiming but also reducing the risk of not achieving the right returns on the climate action investments.

8.3.3 Opportunities for enabling finance in Supply Shed Interventions

Value chain companies with an active interest in claiming reductions from Supply Sheds will have diverse opportunities to tap into finance provided that causality is established and safeguarded in Interventions, and provided that registries are in place to ensure proper tracking of claims.

Opportunities that will emerge in the future for these value chain companies include:

- → Using the Supply Shed concept to de-risk investments. This can be done at multiple levels, e.g., supporting bankability of the Intervention owners at scale, improved assurance systems.
- → Clearly making the case for financial institutions to understand Interventions as part of category 15 of their own reporting. This involves raising awareness among the traditional institutions, and companies learning to communicate and report as such.
- → Leveraging collective action to complement financing opportunities (e.g., using collective guarantees, building capacity at landscape level to reduce the risk of loans, mobilising Voluntary Carbon Finance in synergies with company Interventions).
- → Capitalising credible impact by enabling co-investors to claim impact from the registry.

Furthermore, collaboration between value chain companies and Intervention owners should be valued and rewarded as a high level of impact, as it would ultimately support the development of sustainable low-carbon sectors.

For future exploration:

- **How can non-corporate MRV mechanisms (e.g., a common framework) be implemented in a Supply Shed? Can this be part of collective action efforts?**
- **What is the business case for Voluntary Carbon Finance and parties that cannot claim attribution? How can the benefits be quantified?**
- **What are the mechanisms needed to connect registries in Voluntary Carbon Markets and in Scope 3 to avoid double claiming?**
- **What types of claims can companies make from Interventions where impact cannot be attributed (i.e., "contribution" claims)?**

References

Accountability Framework Initiative. (2019).
Definitions: Key terms that are used in the Accountability Framework Core Principles and Operational Guidance.
URL: https://accountability-framework.org/the-framework/contents/definitions/

Carbon Disclosure Project. (2022).
Measuring Progress Towards a Sustainable Palm Oil Supply Chain, A company's journey.
URL: https://cdn.cdp.net/cdp-production/cms/reports/documents/000/006/522/original/CDP_Palm_Oil_Report_2022_Final.pdf

Chen, Xiaobo & Lee, Jacquetta. (2020).
The Identification and Selection of Good Quality Data Using Pedigree Matrix.
10.1007/978-981-15-8131-1_2.
URL: https://www.researchgate.net/publication/344268534_The_Identification_and_Selection_of_Food_Quality_Data_Using_Pedigree_Matrix

European Commission. (2018).
Product Environmental Footprint Category Rules Guidance. Version 6.3.
URL: https://ec.europa.eu/environment/eussd/smgp/pdf/PEFCR_guidance_v6.3.pdf

Garzón-Jiménez, Renato, and Ana Zorio-Grima. (2021).
Effects of Carbon Emissions, Environmental Disclosures and CSR Assurance on Cost of Equity in Emerging Markets Sustainability 13, no. 2: 696.
URL: https://doi.org/10.3390/su13020696

Gold Standard. (2022).
Accounting & reporting the emissions of certified commodities: Introductory guidance. Version 1.0.
URL: https://www.goldstandard.org/sites/default/files/documents/accounting_opening_guide_-_certificate_holders_and_applicants_final.pdf

Gold Standard. (2021).
Value Chain (Scope 3) Interventions – Greenhouse Gas Accounting & Reporting Guidance. Version 1.1.
URL: https://valuechangeinitiative.com/wp-content/uploads/sites/2/2021/10/11.Value-Change-Interventions-Guidance.pdf.
URL: https://www.researchgate.net/publication/272131030_Overview_and_methodology_Data_quality_guideline_for_the_ecoinvent_database_version_3

IDH. (2019).
Verified Sourcing Areas.
URL: https://www.idhsustainabletrade.com/uploaded/2018/08/VSA-Public-Concept-Note_22August2019.pdf?x30434

Intergovernmental Panel on Climate Change. (2000).
IPCC guidance Chapter 6. Quantifying Uncertainties in Practice. IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.
URL: https://www.ipcc.ch/site/assets/uploads/2018/03/6_Uncertainty-1.pdf

International Organization for Standardization. (2010).
ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines.
URL: https://www.iso.org/standard/38498.html

International Organization for Standardization. (under development).
ISO/DIS 14068 Greenhouse gas management and climate change management and related activities — Carbon neutrality.
URL: https://www.iso.org/standard/43279.html

International Organization for Standardization. (2022).
IWA 42:2022 Net zero guidelines.
URL: https://www.iso.org/standard/85089.html

ISEAL. (2022).
Alliance's Making Credible Jurisdictional Claims – ISEAL Good Practice Guide Version 1.1.
URL: https://www.isealalliance.org/get-involved/resources/making-credible-jurisdictional-claims-good-practice-guide-v11-2022

Nordic Council of Ministers. (2022).
Harnessing Voluntary Carbon Markets for Climate Ambition.
URL: https://pub.norden.org/temanord2022-563/#

Ostrom, Elinor. (2004).
Understanding collective action. International Food Policy Research Institute (IFPRI), 2020 vision briefs.
URL: https://www.ifpri.org/publication/understanding-collective-action

Partnership for Carbon Accounting Financials. (2022).
Financed Emissions Global GHG Accounting & Reporting Standard. Part A. Second edition.
URL: https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf

Roundtable on Sustainable Palm Oil. (2021).
RSPO Jurisdictional Approach Piloting Framework.
URL: https://jaresourcehub.org/wp-content/uploads/2021/10/rspo-jurisdictional-approach-piloting-framework-eng.pdf

Science Based Targets Initiative. (2021).
SBTi Corporate Net-Zero Standard. Version 1.0.
URL: https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf

Science Based Targets Initiative and World Wildlife Fund for Nature. (2022).
Forest, Land And Agriculture Science Based Targetsetting Guidance.
URL: https://sciencebasedtargets.org/resources/files/SBTiFLAGGuidance.pdf

Scherr, Sara et.al. (2015).
The Little Sustainable Landscapes Book: Achieving sustainable development through integrated landscape management.
URL: https://globalcanopy.org/insights/publication/the-little-sustainable-landscapes-book/

Shen, Yijuan, Zhi-Wei Su, Guanhua Huang, Fahad Khalid, Muhammad Bilal Farooq, and Rabia Akram. (2020).
Firm Market Value Relevance of Carbon Reduction Targets, External Carbon Assurance and Carbon Communication. Carbon Management 11 (6): 549–63.
https://doi.org/10.1080/17583004.2020.1833370

SustainCERT S.A. (2021).
SustainCERT Verification Requirements for Value Chain Interventions (Version 0.9). Available upon request

WRI and WBCSD. (2013a).
Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Greenhouse Gas Protocol.
URL: http://www.ghgprotocol.org/ standards/scope-3-standard

WRI and WBCSD. (2013b).
Greenhouse Gas Protocol guidance on uncertainty assessment in GHG inventories and calculating statistical parameter uncertainty.
URL: https://ghgprotocol.org/sites/default/files/ghg-uncertainty.pdf

WRI and WBCSD. (2022).
Greenhouse Gas Protocol Land Sector and Removals Guidance. Part 1: Accounting and Reporting Requirements and Guidance. Draft for pilot testing and review.
URL: https://ghgprotocol.org/sites/default/files/standards_supporting/Land-Sector-and-Removals-Guidance-Pilot-Testing-and-Review-Draft-Part-1.pdf

WRI and WBCSD. (2013b).
Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard.
URL: http://www.ghgprotocol.org/productstandard

Weidema, Bo & Bauer, Christian & Hischier, Roland & Mutel, Chris & Nemecek, Thomas & Reinhard, Juergen &
Vadenbo, Carl & Wernet, G.. (2013).
Overview and methodology. Data quality guideline for the ecoinvent database version 3.
URL: https://www.researchgate.net/publication/272131030_Overview_and_methodology_Data_quality_guideline_for_the_ecoinvent_database_version_3

WWF. (2020).
Credibility and Climate Action: A Corporate Blueprint.
URL: https://wwf.panda.org/wwf_news/?1172766/Blueprint-Corporate-Action-Climate-Nature

Acronyms

Acronym	Definition
BVCM	Beyond Value Chain Mitigation
COE	Cost of Equity
CSR	Corporate Social Responsibility
EEICO	Environmentally Extended Input-Output models
EF	Emission factor
GHG	Greenhouse Gas
GHG P	Greenhouse Gas Protocol
GHGP LSRG	Greenhouse Gas Protocol Land Sector and Removals Guidance
GRI	Global Reporting Initiative
GSD	Geometric Standard Deviation
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
MRV	Monitoring, Reporting, and Verification
OEF	Organisation Environmental Footprint
PCAF	The Partnership for Carbon Accounting Financials
PEF	Product Environmental Footprint Guide
PEFCR	Product Environmental Footprint Category Rules Guidance Version 6.3 – May 2018
QAQC	Quality assurance and Quality Control
SBTi	Science-Based Targets Initiative
SBTi FLAG	Science-Based Targets Initiative's (SBTi) guidance for Forestry, Land Use and Agriculture (FLAG)
ToC	Theory of Change
UNFCCC	United Nations Framework Convention on Climate Change
VCI	Value Change Initiative
VCI Guidance	Value Chain Interventions - Greenhouse Gas, Accounting & Reporting Guidance version 1.1

About the VCI

The Value Change Initiative is a multi-stakeholder forum bringing together some of the world's largest companies, leading civil society actors and internationally recognized climate frameworks to collectively focus on defining best practice for Scope 3 emission reductions and removals at scale.

It is a forum for practitioners that identifies barriers to scaling value chain action, proposes and tests practical solutions, and publishes guidance on the consensus generated.

ValueChange

CO-FOUNDED BY

Gold Standard

SUSTAINCERT