

IFC Workshop on "Addressing climate change data needs: the global debate and central banks' contribution"

6-7 May 2024

We aim to curb emissions – but how can we know
where we stand?¹

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¹ This contribution was prepared for the workshop. The views expressed are those of the authors and do not necessarily reflect the views of the Central Bank of the Republic of Türkiye, the BIS, the IFC or the other central banks and institutions represented at the event.

We aim to curb emissions – but how can we know where we stand?

People and perspectives meet: an international workshop on carbon content measurement

Ulf von Kalckreuth, Deutsche Bundesbank

**CBRT-IFC Workshop on Addressing Climate Change Data Needs: The Global Debate and Central Banks' contribution
Izmir, Türkiye, 6-7 May 2024**

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Irving Fisher Committee on
Central Bank Statistics



Carbon content measurement for products, organisations and aggregates: creating a sound basis for decision making

International workshop organised by the IMF, the BIS/IFC, Eurostat, the Deutsche Bundesbank, the Banco Central de Chile and the University of Oxford Blavatnik School of Government

[Link to conference website, incl presentations](#)

"Only what gets measured, gets managed" (Bo Li)

Reliable and readily available measures of **carbon content** enable:

- **Companies** to align their production processes in a climate-friendly way,
- **Investors** to direct their capital towards climate-friendly investments if they wish,
- **Banks** to better assess the climate risks in their portfolios,
- **Governments and regulators** to intervene if necessary, and
- **Consumers** to better understand the consequences for the environment of their decision to purchase a particular product or service.

Carbon content information is a necessary condition for rational environmentally-oriented decision making.

"Only what gets measured, gets managed" (Bo Li)

Carbon content information is produced and needed on three levels:

- **Aggregate level -- country and sector** **statistics**
- **Company level** **non financial reporting**
- **Product level** **carbon accounting**

As yet, measurements and measurement concepts are unrelated. There is **no joint framework**, **no cross-validation**, no way to use data from one level to **fill data gaps** in the other.

"Only what gets measured, gets managed" (Bo Li)

Carbon content information is produced and needed on three levels:

- **Aggregate level -- country and sector** **statistics**
G 20 Data Gaps Initiative (DGI), ECB ESG climate indicators
- **Company level** **non financial reporting**
ISSB Standards, EU Legislation, specifically CSRD and ESRS
- **Product level** **carbon accounting**
industry initiatives (chemical industry, automobiles), accounting research

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The Hamburg workshop – design

- ⇒ At the workshop, **experts from different fields met** to inform each other on the status quo, the objectives, the way forward, and to discuss synergies.
- ⇒ Workshop **organised by leading questions**, formulated beforehand
- ⇒ Workshop was **designed for interactivity**.
No cfp, no pre-produced papers, many short presentations and discussions
- ⇒ **Two parallel modes:**
 - morning and late afternoon: **in-presence // Chatham house rules**
 - 1-3 pm **open hybrid panels** for maximum international interaction

The Hamburg workshop – topics

- Opening panel: Overarching questions in accounting and statistics of CO₂ emissions
- What do statisticians offer, what do they need from accounting and reporting standard setters?
- Direct and indirect emissions – company-level information management and input-output statistics. Accounting, recordkeeping, and auditing of emissions data in supply chains
- Direct measurement of primary emissions data
- Dissemination: Carbon data platforms
- Closing panel: Summarising results and ways forward

[Link to full program](#)

Some concepts

Special focus

With emission data, we distinguish between

- **Direct emissions (Scope 1)**, generated in production itself

Direct measurement of direct emissions

- **Indirect emissions**, generated in the production of inputs,

Evaluating emissions associated with inputs

 - Emissions due to the use of **energy** and **heat (Scope 2)**

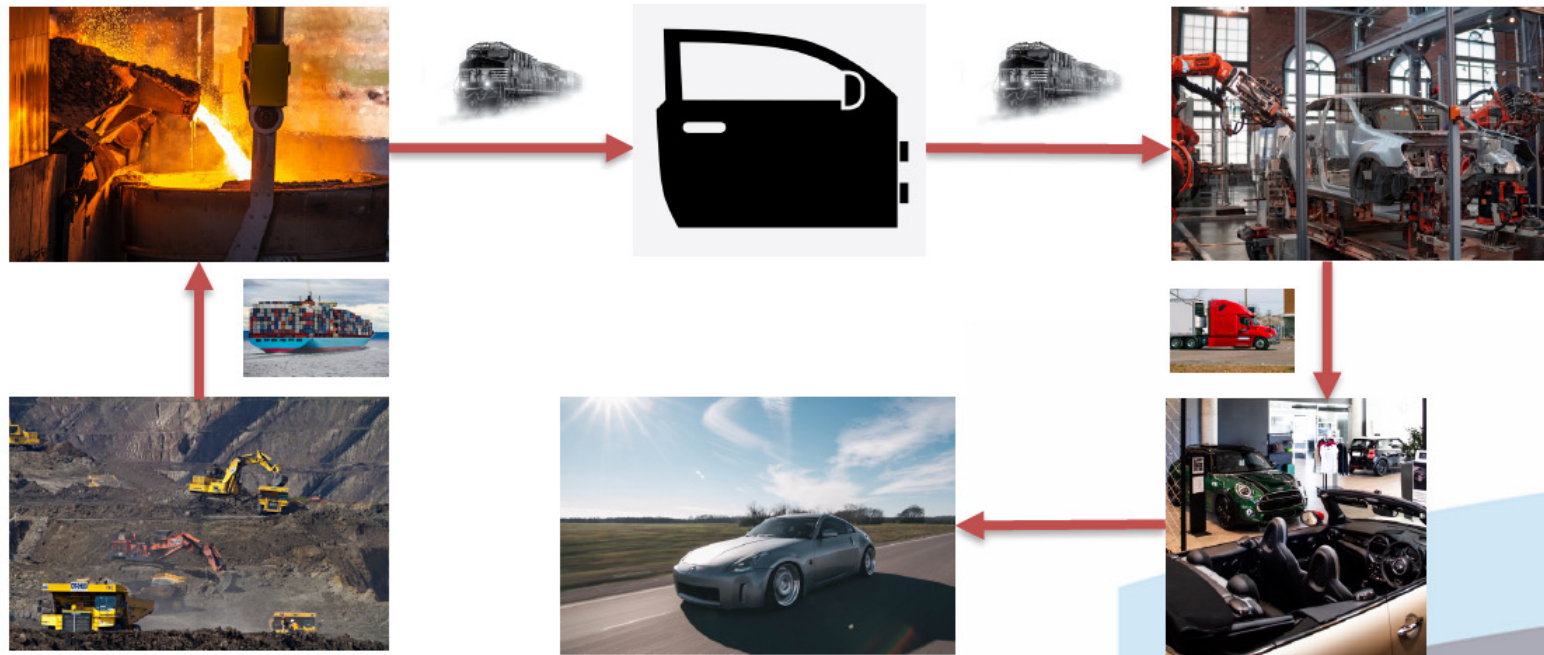
 - **All other** indirect emissions (**Scope 3**)

- **Carbon content** – the sum of direct and upstream indirect emissions.

- Analogous to **total energy content of food**.

Some concepts

E.g., how to calculate the specific carbon emissions in a car door?



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Graph by courtesy of R. Kaplan and K. Ramanna, taken from session 1, levelling-up presentation

Indirect emissions and total carbon content

Consider the *bill of material* (BoM) of product k , with $a_{k,i}$ being the quantity of good i embodied in the production process:

$$\mathbf{a}_k = (a_{k1} \quad a_{k2} \quad \dots \quad a_{kK})'$$

Let d_k be the amount of GHG directly emitted and c_i be the carbon content of input i

direct emissions

indirect emissions

valuation structure of inputs

Then the carbon content of good k is given as the **sum of direct and indirect emissions**:

Carbon content vector

$$c_k = d_k + \mathbf{c}'\mathbf{a}_k = d_k + \sum_i c_i a_{ki} \quad (1)$$

quantity structure of inputs

If the c_i are known, we can calculate the carbon content of product k directly.

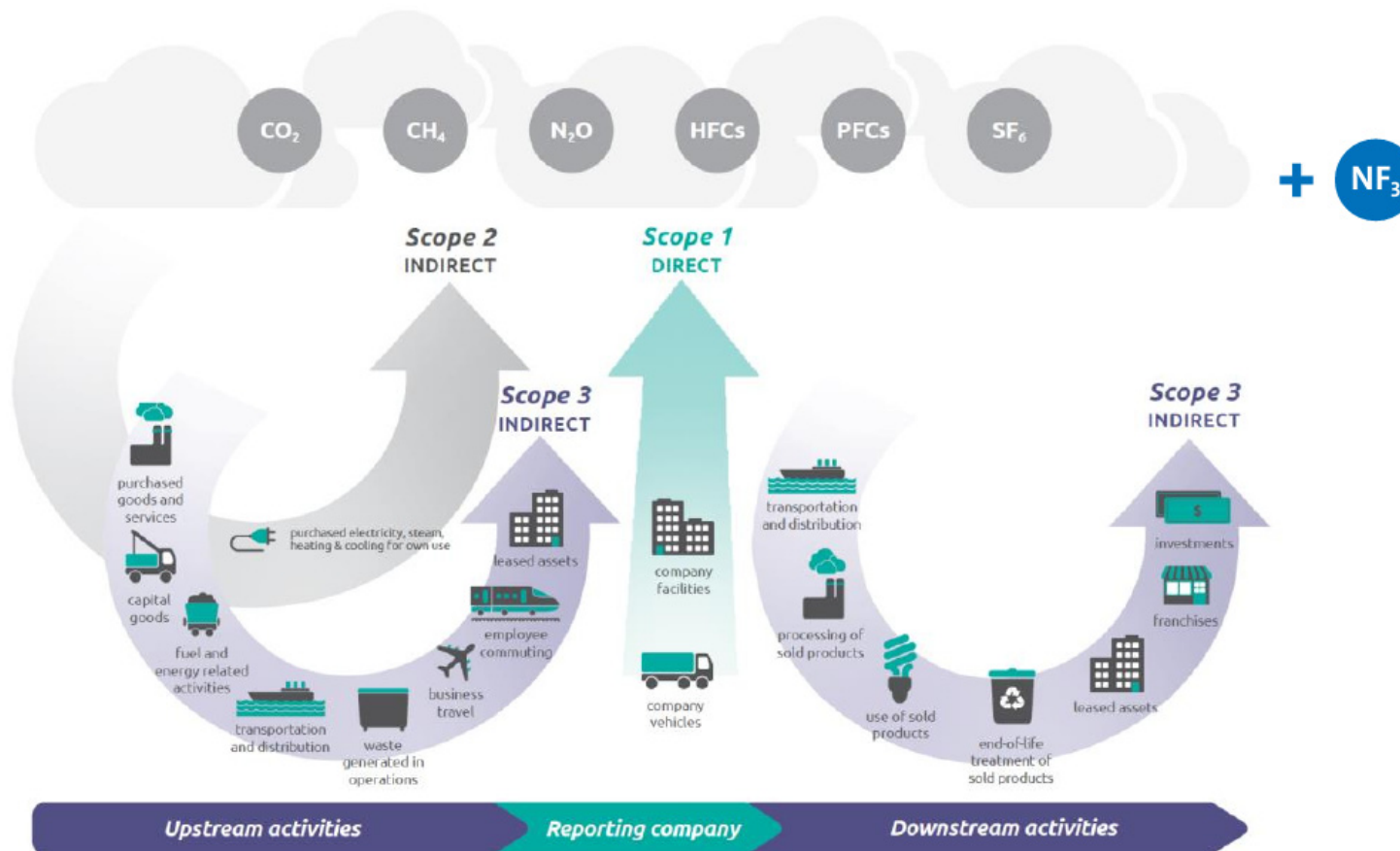
The hen and the egg problem

What if we do not know the carbon content of our inputs?

Three types of answers:

- Try to understand your value chain and quantify direct emissions on each stage, then sum up
Drilling down the value chain: The tao of the GHG protocol
- From knowledge of input requirements, solve for carbon content of all products in the system
Explicit knowledge: The tao of IO
- Make your input provider give you the required information
Implicit knowledge: The tao of cumulative carbon accounting

The tao of GHG Protocol



Source: Greenhouse Gas Protocol (2011): *Corporate value chain (Scope 3) accounting and reporting standard*.



The tao of IO

If the c_i are unknown, the equation is **recursive**. Equation (1) is an **IO model for production**. We can solve for the GHG value of all products simultaneously. Let

$$\mathbf{A} = (\mathbf{a}_1 \quad \mathbf{a}_2 \quad \dots \quad \mathbf{a}_K)$$

be the matrix of the BoMs for all produced goods. With $\mathbf{d}$ the vector of direct emissions for products 1,..., K , we may write:

$$\mathbf{c}' = \mathbf{d}' + \mathbf{c}'\mathbf{A}$$

and solving for $\mathbf{c}$ yields

This is how actual IO works using industry level data from different countries.

It also shows how the carbon content of products is derived from direct emissions and interlinkages

$$\mathbf{c}' = \mathbf{d}'(\mathbf{I} - \mathbf{A})^{-1}$$

(2)

Carbon contents
of all goods

Direct emissions
for all goods

Leontief inverse, reflecting
production interlinkages

Cumulative carbon accounting – the tao of E-Liability

E-liability is the most prominent version of cumulative carbon accounting. Proposed and developed by **R. Kaplan (Harvard) and K. Ramanna (Oxford)** since 2021.

E-liability works straight from the definition of carbon content:

$$c_k = d_k + \mathbf{c}'\mathbf{a}_k = d_k + \sum_i c_i a_{ki}$$

Carbon content is cumulative, like VAT, thus carbon content information is passed through the system, from input provider to producer and further down the supply chain, to the end-user.

To allocate emissions to output, all standard methodology of cost accounting is used! Direct and indirect emissions are treated as an **accounting liability**.

Direct information from providers or own measurement have highest priority. Data gaps filled using estimates, eg from statistics. If carbon contents provided by suppliers are used throughout the system, carbon contents will converge, even if starting values are bad (von Kalckreuth, 2022, 2024)

Common points emerging

The workshop was a testing ground for identifying joint views and shared issues to solve, among industry specialists, academics, standards-setters, central bankers, and statisticians.

Key message: carbon content information can be gathered and processed alongside financial information, using the same concepts and the same infrastructure:

- Balance sheets
- Financial and cost accounting

This is a **vision** and a **challenge**

Essential role of carbon content – direct plus upstream indirect emissions -- for cumulative carbon accounting

Common points emerging

The workshop was a testing ground for identifying joint views and shared issues to solve, among industry specialists, academics, standards-setters, central bankers, and statisticians.

- Crucial role of **reliable and relevant carbon content data** at both macro and micro levels
- We need to move fast, therefore the need to **leverage on what exists**
- Need for a global approach -- **compatible standards**
- The importance of **process efficiency**, minimising burdens on entities
- The application of latest **digital technologies** for compilation, reporting and data flow
- The role of **incentivisation** techniques
- The benefits of **inter-disciplinary cooperation** (industry specialists, academics, standards-setters, central bankers, statisticians...)

The statistical angle

- Macro statistics are the predominant form of public data available now
- But they are:
 - **Highly based on assumptions** >> can be improved with data from industry
 - **Not granular** >> need to work on more detailed industry/product breakdowns
 - **Patchy in coverage** across countries >> role of Data Gaps Initiative
 - Role of statistics to help filling gaps and support convergence in microdata
- Importance of efficient **statistical access to emerging microdata, sharing of classifications and definitions** where possible

Disclosure or accounting – or both?

- Establishing a **distinction** between them...
- Many current initiatives based on **disclosure**
 - But unlikely they will organically develop into accounting
 - **Engagement with standard setters** on future direction
- The underlying principle of “passing on” carbon content (e.g. on invoices) can be applied in both disclosure and accounting approaches
- E-liabilities based on double entry accounting.
- Ordinary cost accounting does not need audits, as the information it generates is for internal use only. This is different with carbon accounting.
- Need to identify who could actually create carbon accounting standards.

Direct measurement

- Situation is **unsatisfactory**. Estimates and rules of thumb predominate. No clear view of total emissions
- Workshop saw many innovative approaches...
- Increasing role of **satellite imagery** → in this conference an entire session
 - Certainly at macro level
 - Surprising advances at micro level
- Combining / contrasting direct measurement data – they can build on each other
- How can developing expertise at industry and scientific levels be pooled?

Sectoral aspects

- Need for a **unified system for carbon content measurement**
- Some sectors are:
 - **more relevant** than others (fossil fuels, cement, chemicals, cars, steel...)
 - **already working in a collaborative way** within their specific situations
- **Small entities** need a simple way to contribute 'bottom-up', leveraging on statistical data
 - E.g. work of Carbones sur Factures, IDG security
- Consider **government entities**...
 - as reporters ...
 - as major procurers

Making information available

- Challenge to present carbon content data alongside financials
 - **At macro level** for policy purposes
 - **At entity level**, alongside financial statements
 - **On products** in an informative and standardised way
- How to bring data together?
 - **Commercial initiatives**
 - **The ECCBSO / CMFB** initiative: collecting CSRD company level data for statistics
 - Possible proliferation of data bases

In sum – what is needed

The workshop concluded that at the level of products, companies, industries, and countries we need carbon content information that is **accurate, interoperable, trustworthy, and available.**

Accuracy needs **high quality internal reporting of direct emissions and input structures**, with standard cost accounting procedures providing a robust framework. Where carbon content data on inputs is lacking, suitable proxies need to be used.

Consistent and interoperable indicators require **common standards**, defining inputs, allocation processes, and the treatment of carbon content over time. As a standard input for carbon accounting, direct and upstream indirect carbon content is of vital importance

Trustworthiness and the value of the data in external transactions hinge on **verification and auditing**, reinforcing the integration of carbon accounting within financial and cost accounting.

Communication devices, such as carbon content on bills and data exchange platforms, are necessary for promoting **availability.**

In sum – what is needed

- **Bo Li** demands '*collaboration and innovation*' on our way towards a functioning system of information on carbon contents.
 - Setting the required standards and promoting them needs *international collaboration*.
 - Making useful data available on all levels needs *innovation*, also from statisticians.
 - Direct measurement
 - Processing, storage and passing on of information
 - *Timely and consistent information on country and industry totals* are an important backbone in the emerging system of carbon content information.