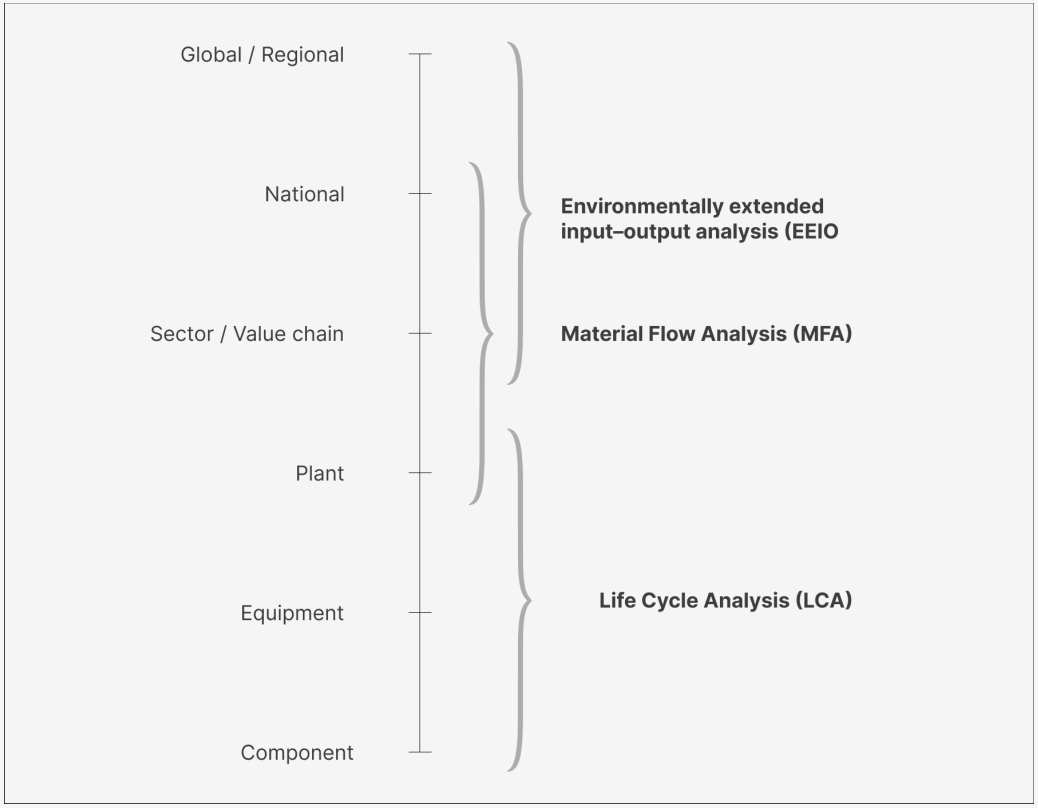
Enhancing the Embodied Environmental Footprint Estimations of ICT: Leveraging EEIO Techniques

Thibault SIMON

Industrial ecology accounting frameworks



Adapted from Stadler, K., Pauliuk, S., Myers, R., Heeren, N., Majeau-Bettez, G., Kuczenski, B., … Hertwich, E. (2018). *The Industrial Ecology Open Science Project.* doi:10.5281/ZENODO.1455749

Bottom-up approaches

Reference studies on ICT's environmental footprint use *bottom-up* approaches, (e.g. LCA)[1]

[1] Freitag, C., Berners-Lee, M., Widdicks, K., Knowles, B., Blair, G. S., & Friday, A. (2021). The real climate and transformative impact of ICT: A critique of estimates, trends, and regulations. *Patterns, 2*, 100340. doi:10.1016/j.patter.2021.100340

Bottom-up approaches

Often limited to a single impact category: GHG emissions

Propagate low-levels studies shortcomings

Limited feedback on metals and minerals, hiding their *criticality*

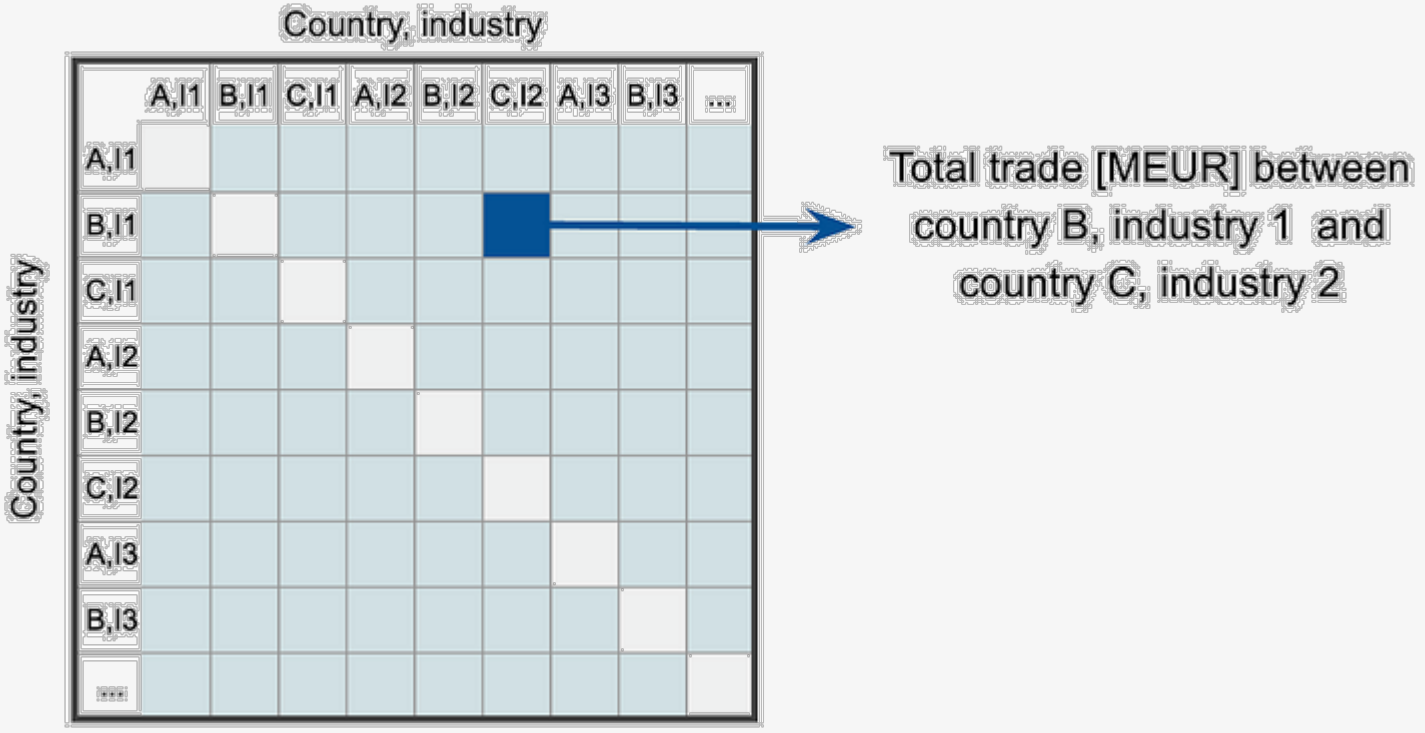
LCA fails to capture mineral criticality

Abiotic resource depletion potential (ADPFe)

https://www.fairphone.com/en/impact/fair-materials/

Environmentally extended input–output analysis (EEIO)

Multi-Regional Input Output modeling (MRIO)



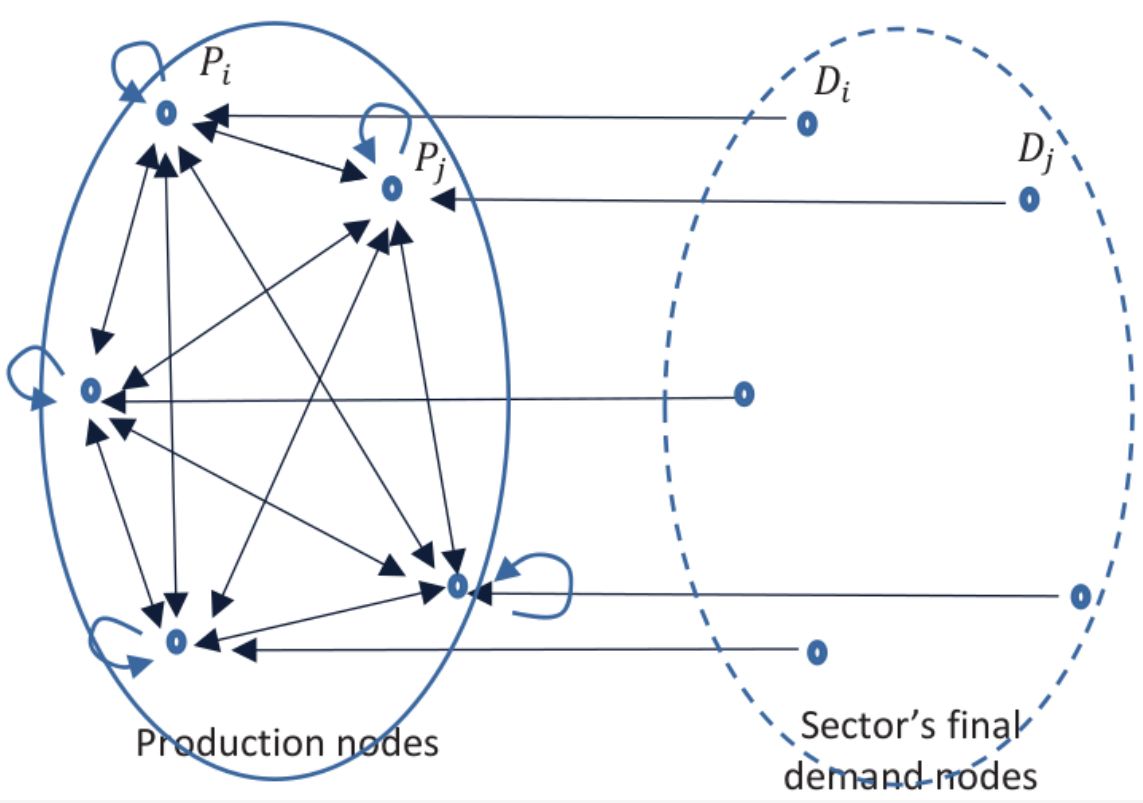
Source

Environmentally extended Input Output (EEIO)

	AT		BE		BG	
	Computer and related activities	Insurance	Computer and related activities	Insurance	Computer and related activities	Insurance
GHG emissions (kg CO2 eq./M€)	3,521.73	3,500.97	23,257.78	7,580.25	8,574.31	109,490.36
Fresh water Ecotoxicity (PAF*m3*day/M€)	6.89	16.68	283.88	17.67	10.92	4201.36
NOx emissions (Kg/M€)	3.17	4.54	16.88	4.93	7.71	699.01

Source

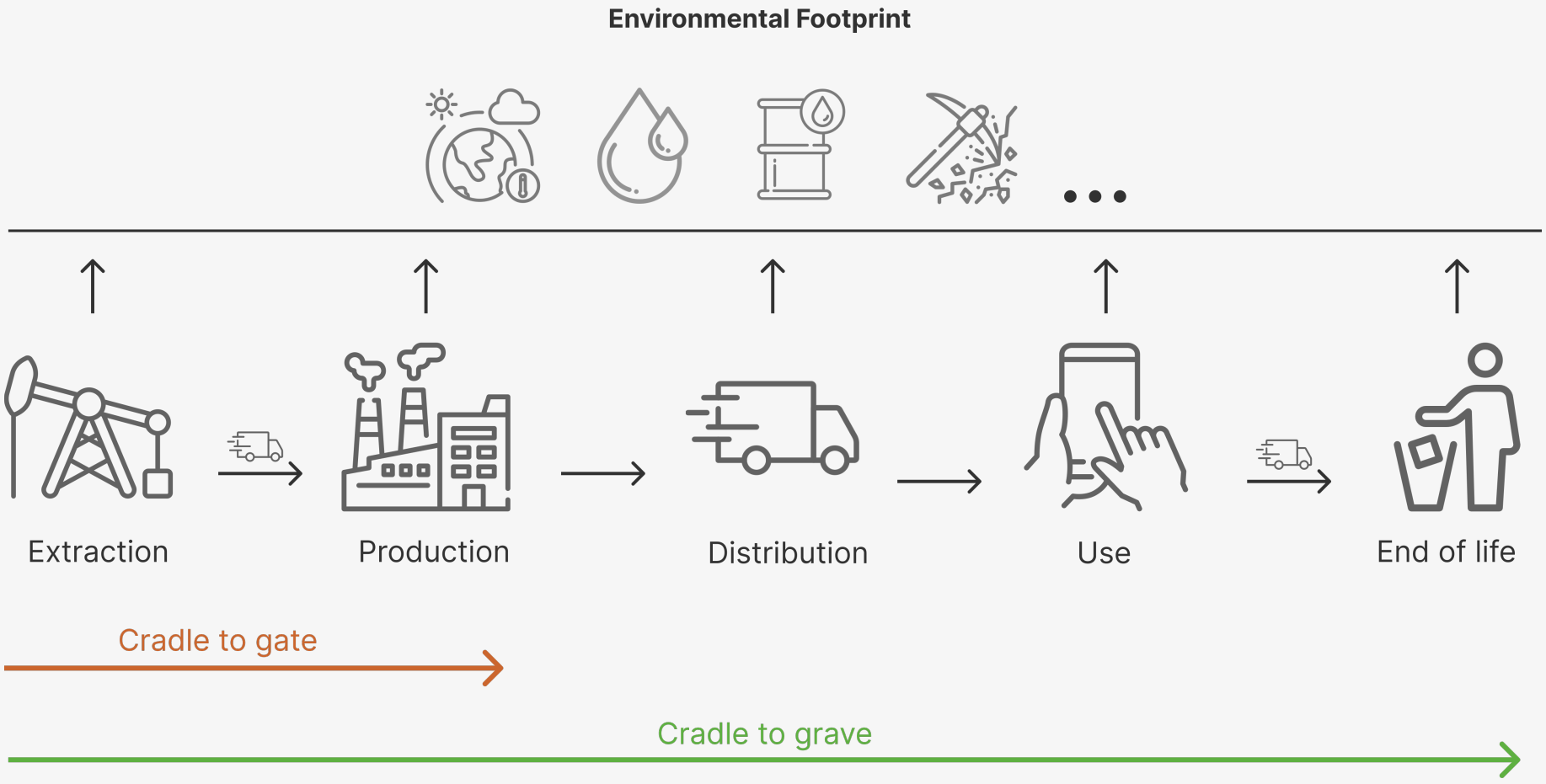
Leontief modeling



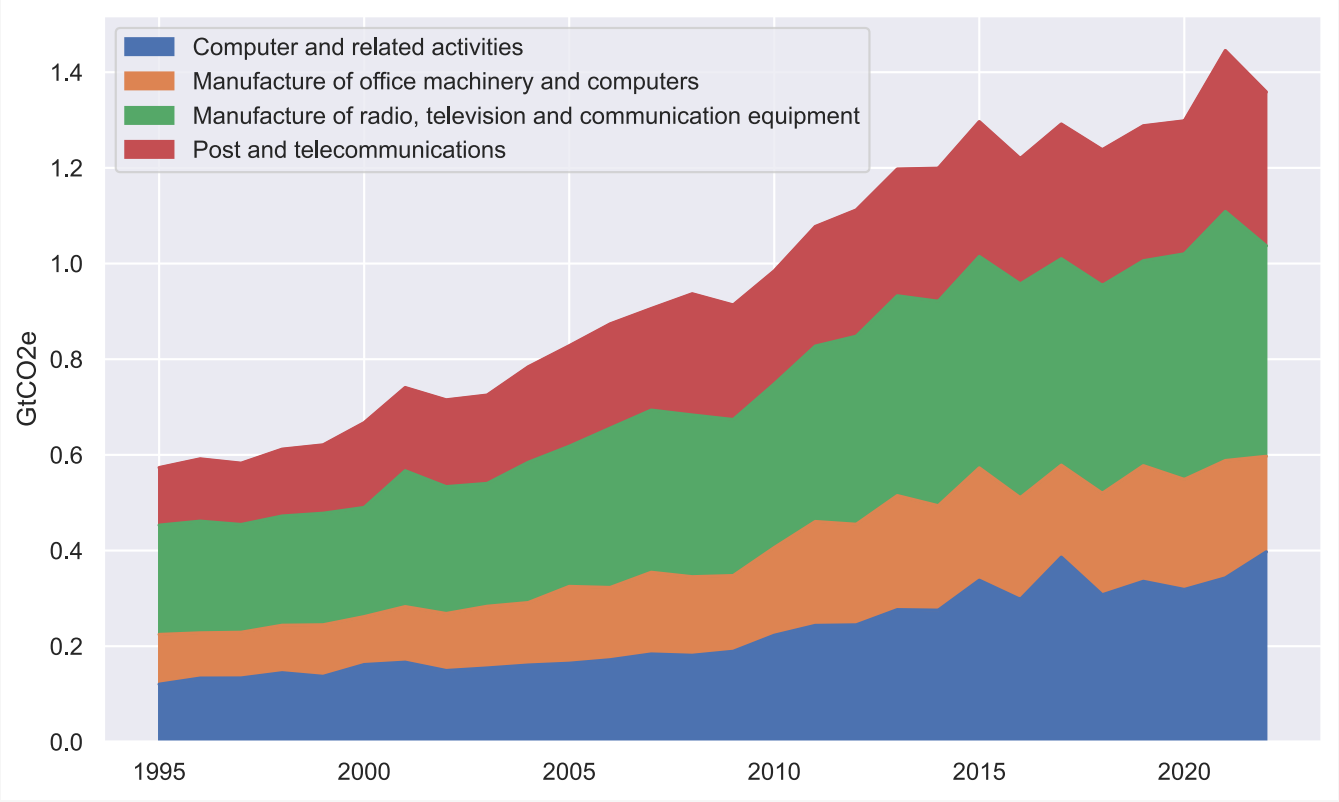
Charpentier, F. (2022). An Impact Inheritance Approach to the Estimation of the Carbon Footprints of Economic Activities. *2022 International Conference on ICT for Sustainability (ICT4S)*, 140-149. doi:10.1109/ICT4S55073.2022.00025

Leontief modeling allows to easily trace the **cradle-to-gate** impact for a sector

Cradle to gate

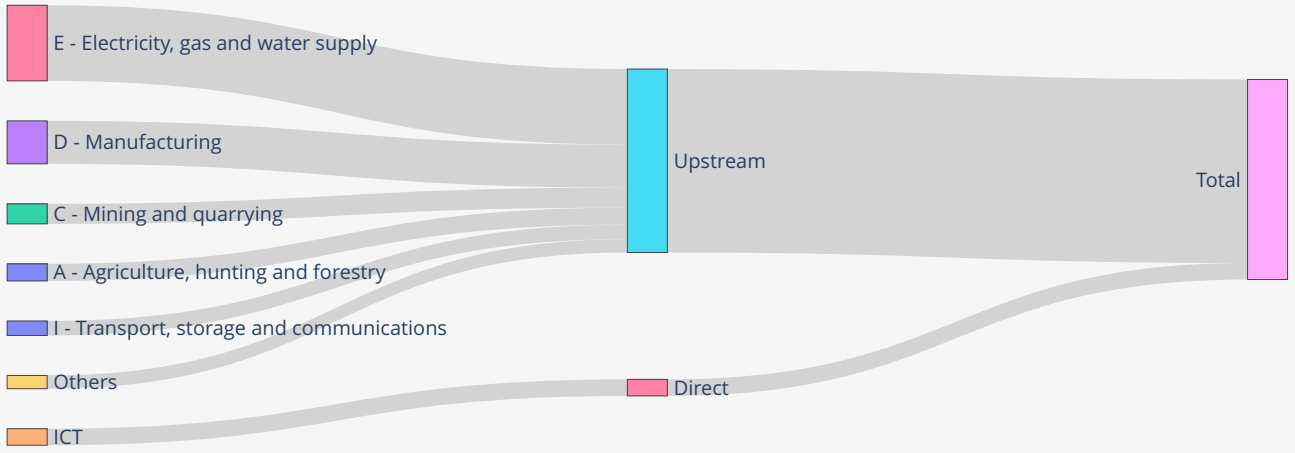


EEIO: Compute a sector's upstream and its evolution



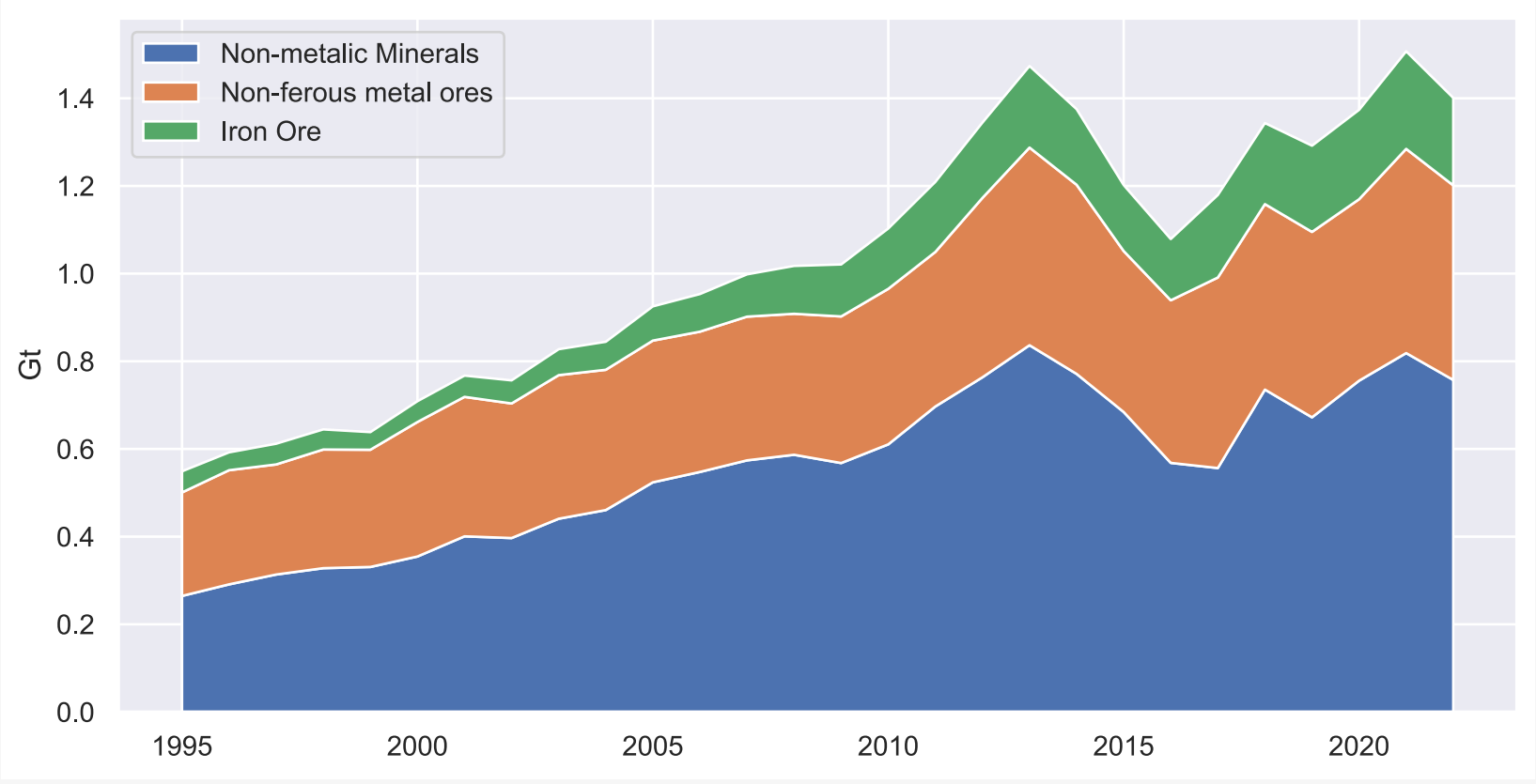
ICT sector's upstream footprint evolution (1995-2022) - Exiobase

EEIO: retrace impact providers



ICT upstream GHG emissions sources (2015) - Exiobase

EEIO: Assess a sector's upstream footprint over multiple categories



ICT induced mineral extraction evolution (1995-2022) - Exiobase

Conclusion: EEIO

A methodology to compute ICT's sector environmental footprint using open-data

Over multiple categories, notably deeper mineral analysis

Over time - With the possibility to trace impact's origin

Familiar with EEIO? Shoot me an email: thibault.simon@orange.com