

## **Discovering fixed-capital categories resulting in significant material and carbon footprints, with application to Japanese material flow**

Topic: Consumption-based accounting (Chair: Bart Los, University of Groningen)

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Production and services in modern society are supported by fixed-capital, such as production facilities, infrastructure, and durable consumer goods, in which large amounts of resources are invested. Considering that material use triggers substantial carbon emissions, understanding the relationship between the materials consumed via fixed-capital formation and carbon emissions is a prerequisite for achieving climate change targets. We developed a fixed-capital endogenizing input-output model to calculate capital-embodied material footprints (MF) and their induced carbon emissions. Decomposing the capital-embodied MF into two supply chain effects (production and fixed-capital formation) allows us to separate the supply chain effects to material use and carbon emission. To apply the model to the 2015 Japanese economy, we developed an original material flow database. As the result, we identified that the fixed-capital supply chains were responsible for 454 million tons MF, which account for one-third of the total MF induced by household consumption. The carbon emissions per unit MF of the fixed-capital supply chain, 0.46 t-CO<sub>2</sub>eq/t, was as much as half of that of the production supply chain. The fixed-capital supply chain for the service sectors caused 168 million tons MF and indicated the high level of carbon intensity among nine fixed-capital supply chains. Our findings highlight that breaking the stimulus to the fixed-capital formation by service industries is imperative for curbing material use and carbon emissions. Strengthening circular economy policies and companies' and cities' Scope 3 carbon management, focusing on fixed-capital, will be instrumental in driving this change.