

The true raw material footprint of nations

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The amount of raw materials needed to sustain the economies of developed countries is significantly greater than presently used indicators suggest, a new Australian study has revealed.

Using a new modelling tool and more comprehensive indicators, researchers were able to map the flow of [raw materials](#) across the [world economy](#) with unprecedented accuracy to determine the true "material footprint" of 186 countries over a two-decade period (from 1990 to 2008).

The study, involving researchers from the University of New South Wales, CSIRO, the University of Sydney, and the University of California, Santa Barbara, was published today in the US journal *Proceedings of the National Academy of Sciences*. It reveals that the decoupling of natural resources from economic growth has been exaggerated.

The results confirm that pressures on raw materials do not necessarily decline as affluence grows and demonstrates the need for policy-makers to consider new accounting methods that more accurately track resource consumption.

"Humanity is using raw materials at a level never seen before with far-reaching environmental impacts on biodiversity, land use, climate and water," says lead author Tommy Wiedmann, Associate Professor of Sustainability Research at the UNSW School of Civil and Environmental Engineering. "By relying on current indicators, governments are not able to see the true extent of resource consumption."

"Now more than ever, developed countries are relying on international trade to acquire their natural resources, but our research shows this dependence far exceeds the actual physical quantity of traded goods," says Wiedmann, who worked at CSIRO Ecosystem Sciences when the research was undertaken.

In 2008, the total amount of raw materials extracted globally was 70 billion metric tons – 10 billion tons of which were physically traded. However, the results show that three times as many resources (41% or 29 billion tons) were used just to enable the processing and export of these materials.

The researchers say that because these resources never leave their country of origin, they are not adequately captured by current reporting methods. They have used a new indicator they call the "material footprint" to more accurately account for these 'lost' resources and have developed tools that could assist policy-makers in future.

Economy-wide accounting metrics (such as Domestic Material Consumption or DMC) currently used by certain governments and intergovernmental organisations, including the OECD, the European Union and the UN Environment Programme, only account for the volume of raw materials extracted and used domestically, and the volume physically traded.

These indicators suggest resource-use in wealthy nations has increased at a slower rate than economic growth – something known as relative decoupling – and that other countries have actually seen their consumption decrease over the last 20 years – something known as absolute decoupling. (See figures).

Decoupling of raw material usage from economic growth is considered one of the major goals en route to achieving sustainable development and a low-carbon economy.

But the study authors say when their "material footprint" indicators are factored in these achievements in decoupling are smaller than reported and often non-existent.

The study relates to the following resources: metal ores, biomass, fossil fuels and construction minerals.

Selected country findings:

- In 2008 China had by far the largest material footprint (MF) in absolute values (16.3 billion tons), twice as large as that of the US and four times that of Japan and India. Sixty per cent of China's MF consists of construction minerals, reflecting its rapid industrialisation and urbanisation over the last 20 years.
- Australia had the highest material footprint per capita (about 35 tons per person), but because it is a prolific exporter of resources, it appears to have a relative decoupling. Other developed economies (USA, Japan, UK) show similar levels at around 25 tons per person.
- Lower material standard of living and lower average level of consumption in many developing countries is reflected in a footprint below 15 tons per person, with India at the lower end at 3.7 tons per person.
- In absolute values, the US is by far the largest importer of primary resources embodied in trade and China the largest exporter. The largest per-capita exporters of embodied primary materials – in particular metal ores – are Australia and Chile.
- All industrialised nations show the same typical picture over time: as GDP grew over the last two decades there appeared to be a relative decoupling of resource use as indicated by DMC (even absolute decoupling for the UK). However, when measured by the material footprint indicator, resource use has grown in parallel to GDP with no signs of decoupling. This is true for the USA, UK, Japan, EU27 and OECD.
- South Africa was the only country shown to have an absolute decoupling using the MF indicator.

More information: The material footprint of nations ,
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