

The ponderous side of GVCs: characterising local economies and their material footprint, a European perspective.

In the face of accelerating ecological crisis, countries worldwide are expected to radically transform their economic models. European countries are no exception and are thus in the process of implementing various mitigation policies. Yet the territorial dimensions of such positioning appear underdiscussed.

In the 20th century however, regional studies provided theoretical insights to conceive regions as a blend of economic and ecological dimensions, through a physiographic approach (Friedmann and Weaver 1979). Pedology, climate, natural resource endowments were not deterministic of a region's trajectory but nonetheless constituted limiting factors to be taken into account to define regions' boundaries or undertaking comprehensive development plans (National Resources Committee 1935). In this context, regional sciences contributed to the elaboration of new methods to quantify the ecological requirements of economic processes systematically (Isard 1972). This momentum was short-lived though: national integration, post-war impetus for reconstruction all but put both regional and physiographic dimensions of development in the background (Rose, Folmer, and Nijkamp 2014).

The progressive disconnection between economics and ecology has led to the promotion of development paths that retrospectively appear as unsustainable. For a time, regional economies, especially in the North were seemingly freed from regional limiting factors. Through local upgrading, they were able to specialise into high value-added ends of global value chains (Crescenzi and Harman 2023), which also appeared as less material-intensive. Recent work on unequal ecological exchange show that the resulting economic prosperity of these regions is in fact the product of a massive extraction of materials, bought at low prices from Global South countries (Essletzbichler et al. 2023). Bringing regional economic development in the North within planetary boundaries (Rockström et al. 2009) therefore calls for renewed attention to territorial as well as extra-territorial ecological linkages.

Literature on social ecology and territorial ecology has already provided evidence of the reliance of regions on distant material flows (Bahers and Rosado 2023; Piñero et al. 2020). It is also building on ever-more sophisticated data, for instance through refined environmentally-extended MRIO datasets tracking the material footprint of countries (Eisenmenger et al. 2016; Lenzen et al. 2022). Yet research estimating these flows at subnational level is still scarce. Downscaling methods are emerging but they face many challenges (Bianchi, Tapia, and Del Valle 2020; Wiedmann, Athanassiadis, and Binder 2023). Such work is crucially needed though, as the most stringent policies are mainly devised at national level, with few concerns for their spatial fallout (Binz et al. 2020). Moreover, the few existing subnational material flows analyses attach little importance to the economic organisation of places, despite increasing economic polarisation and widening inequalities in Europe (Diemer et al. 2022) which also entail material reconfigurations. For instance, the most dynamic regions tend to be the ones that specialised in knowledge intensive activities, but some European regions also escaped development traps by turning to heavy, material-intensive industries (Rodríguez-Pose and Bartalucci 2023). This points to a variety of profiles of economically successful regions with respect to their ecological regional functions that could benefit from further investigation.

In light of these elements, the research will build a typology characterising European local economies though their economic specialisation and trajectories, but also with regards to their material profile. It will build on existing economic data and will also propose a methodology for downscaling existing EE-MRIO data at regional levels. This will bring fresh understanding of how local economies, already differentiated through their economic features, are also divergent in the way they extract, trade and consume material resources. The typology will include a sensitivity to the type of material resources mobilised by each territory, to provide a clear view of inter-territorial material interdependences. This could help identifying how legally-binding transition policies formulated at European or national scale will interact and sometimes clash with economic and material profiles of local places.

- Bahers, Jean-Baptiste, and Leonardo Rosado. 2023. 'The Material Footprints of Cities and Importance of Resource Use Indicators for Urban Circular Economy Policies: A Comparison of Urban Metabolisms of Nantes-Saint-Nazaire and Gothenburg'. *Cleaner Production Letters* 4 (June): 100029. <https://doi.org/10.1016/j.clpl.2023.100029>.
- Bianchi, Marco, Carlos Tapia, and Ikerne Del Valle. 2020. 'Monitoring Domestic Material Consumption at Lower Territorial Levels: A Novel Data Downscaling Method'. *Journal of Industrial Ecology* 24 (April). <https://doi.org/10.1111/jiec.13000>.
- Binz, Christian, Lars Coenen, James T. Murphy, and Bernhard Truffer. 2020. 'Geographies of Transition—From Topical Concerns to Theoretical Engagement: A Comment on the Transitions Research Agenda'. *Environmental Innovation and Societal Transitions* 34 (March): 1–3. <https://doi.org/10.1016/j.eist.2019.11.002>.
- Crescenzi, Riccardo, and Oliver Harman. 2023. *Harnessing Global Value Chains for Regional Development: How to Upgrade through Regional Policy, FDI and Trade*. 1st ed. London: Routledge. <https://doi.org/10.4324/9781003356141>.
- Diemer, Andreas, Simona Iammarino, Andrés Rodríguez-Pose, and Michael Storper. 2022. 'The Regional Development Trap in Europe'. *Economic Geography* 98 (5): 487–509. <https://doi.org/10.1080/00130095.2022.2080655>.
- Eisenmenger, Nina, Dominik Wiedenhofer, Anke Schaffartzik, Stefan Giljum, Martin Bruckner, Heinz Schandl, Thomas O. Wiedmann, Manfred Lenzen, Arnold Tukker, and Arjan Koning. 2016. 'Consumption-Based Material Flow Indicators — Comparing Six Ways of Calculating the Austrian Raw Material Consumption Providing Six Results'. *Ecological Economics* 128 (August): 177–86. <https://doi.org/10.1016/j.ecolecon.2016.03.010>.
- Essletzbichler, Jürgen, Manuel Scholz-Wäckerle, Lena Gerdes, Hans-Peter Wieland, and Christian Dorninger. 2023. 'Geographical Evolutionary Political Economy: Linking Local Evolution with Uneven and Combined Development'. *Cambridge Journal of Regions, Economy and Society* 16 (3): 543–60. <https://doi.org/10.1093/cjres/rsad014>.
- Friedmann, John, and Clyde Weaver. 1979. *Territory and Function : The Evolution of Regional Planning*. Berkeley : University of California Press. <http://archive.org/details/territoryfunctio00john>.
- Isard, Walter. 1972. *Ecologic-Economic Analysis for Regional Development*. The Free Press.
- Lenzen, Manfred, Arne Geschke, James West, Jacob Fry, Arunima Malik, Stefan Giljum, Llorenç Milà i Canals, et al. 2022. 'Implementing the Material Footprint to Measure Progress towards Sustainable Development Goals 8 and 12'. *Nature Sustainability* 5 (2): 157–66. <https://doi.org/10.1038/s41893-021-00811-6>.
- National Resources Committee. 1935. 'Regional Factors in National Planning and Development'.
- Piñero, Pablo, David Pérez-Neira, Juan Infante-Amate, María L. Chas-Amil, and Xoán R. Doldán-García. 2020. 'Unequal Raw Material Exchange between and within Countries: Galicia (NW Spain) as a Core-Periphery Economy'. *Ecological Economics* 172 (June): 106621. <https://doi.org/10.1016/j.ecolecon.2020.106621>.
- Rockström, Johan, Will Steffen, Kevin Noone, Åsa Persson, F. Stuart Chapin, Eric Lambin, Timothy M. Lenton, et al. 2009. 'Planetary Boundaries: Exploring the Safe Operating Space for Humanity'. *Ecology and Society* 14 (2). <https://doi.org/10.5751/ES-03180-140232>.
- Rodríguez-Pose, Andrés, and Federico Bartalucci. 2023. 'The Green Transition and Its Potential Territorial Discontents'. *Cambridge Journal of Regions, Economy and Society*, November, rsad039. <https://doi.org/10.1093/cjres/rsad039>.
- Rose, Adam, Henk Folmer, and Peter Nijkamp. 2014. 'Walter Isard's Contributions to Environmental Economics and Ecological Economics'. *International Regional Science Review* 37 (1): 107–22. <https://doi.org/10.1177/0160017612459052>.
- Wiedmann, Nicole S., Aristide Athanassiadis, and Claudia R. Binder. 2023. 'Streamlining the Regionalization of Economy-Wide Material Flow Accounts (EW-MFA): The Case of Swiss Cantons'. *Cleaner and Responsible Consumption* 10 (September): 100127. <https://doi.org/10.1016/j.clrc.2023.100127>.