A vision for enhanced collaboration in Industrial Ecology

Keynote presentation – Professor Manfred Lenzen

Industrial Ecology in the Asia-Pacific Century: Interdisciplinary science for building sustainable industrial systems and human settlements
11th International Society for Industrial Ecology (ISIE) Socio-Economic Metabolism section conference and 4th ISIE Asia-Pacific conference
Melbourne, Australia, Monday 17 November 2014

Industrial Ecology is experiencing the development of competing databases, analytical methods, and tools. One example are recent advances in Life-Cycle Assessment (LCA) and footprint analysis. Whilst some competing analytical methods are aimed at different research problems, competing databases and tools are sometimes used to answer identical research questions. For example, there are a number of physically-extended global input-output databases available for footprinting exercises, and a number of widely used software products for undertaking LCAs. On one hand, competition can catalyse innovation, but on the other hand it can lead to resource inefficiencies when database and tool construction efforts are duplicated by different research teams, and when extensive comparative assessments are required to clarify where databases and tools differ from one another.

Global multi-region input-output (MRIO) databases are a case in point: These frameworks have recently experienced a burst of high-level applications, as published for example by Hertwich and Peters on carbon emissions (GTAP), by Tukker and colleagues on the EU's energy, water and land footprints (EXIOBASE), by Wiedmann, Schandl and co-workers on resource efficiency and material flow (Eora), by Timmer, Dietzenbacher, Los, Stehrer and colleagues on global value chains and trade in value added (WIOD), and by the ISA group on biodiversity (Eora). However, a large number of identical data sources were collected and used in isolation by the various teams during the construction of the databases. Moreover, the diverging results obtained from using different MRIO databases have resulted in doubts about the reliability of the MRIO approach for geopolitically significant applications, and have spawned an entire Special Issue in the journal *Economic Systems Research* on inter-comparisons of MRIO systems.

One strategy for avoiding the downfalls of competition and isolation is for governments to provide research infrastructure that allows teams to collaborate and share resources. Focusing on the Asia-Pacific region: In Australia, government has been investing in advanced information and communication technologies including high-performance computing, data management and access facilities, and networking infrastructure, in order to streamline research workflows and enable new opportunities for innovation, collaboration, and improved efficiencies, and thus

support and engage major research communities by enabling collaboration across multiple research disciplines and problem-oriented research domains. One of the investment flagships is the *Virtual Laboratory* (VL), a novel concept aimed at improving digital connectivity by linking existing and new research facilities, data repositories and computational tools. In Australia, VLs are created and administered under the lead of the University of Melbourne's NeCTAR project, and financed by the Australian Government's Education Investment Fund. The Australian *Industrial Ecology Virtual Laboratory (IELab)* is a NeCTAR VL that targets a well-described, significant research challenge: the compilation and use of a time series of Australian subnational, environmentally-extended MRIO tables, and their application to LCA and footprinting, all occurring in a cloud-computing environment. Following the IELab's launch, the Australian Research Council is now funding the creation of a Global MRIO Lab, aimed at adopting the concept at a global level and combining the strengths of some of the existing global MRIO frameworks.

Providing technical infrastructure is not sufficient on its own to create incentives for researchers to share their resources and intellectual property. Two further essential ingredients are a) mechanisms to reward contributions to the Lab, and b) support and guidance by a recognized supra-regional organization. In joining nine Australian multi-disciplinary research teams, the Australian IELab has met the collaboration challenge by ensuring that contributors' work is protected (for example by compiling code or password-protecting confidential data) and acknowledged (for example through mandatory citations by users and license fees for commercial applications). Equally important, the IELab's direction is co-steered by the Australian Bureau of Statistics, ensuring that IELab outputs conform to national accounting standards, thus instilling credibility and trust in users. Further plans for IELab include adding dynamic simulation capability to enable the evaluation of sustainability scenarios using economy-wide, consequential LCA and footprinting.

The IELab's success so far is encouraging for the development of the Global MRIO Lab. Whilst the technical infrastructure can largely remain identical, new challenges arise in form of forging lasting collaborations between international research organisations, and engaging institutions of global governance such as the OECD and the UN in providing the Global MRIO Lab with guidance and assurance. The long-term hope of the researchers currently involved with the labs is that the VL concept becomes best-practice and a reference point for doing LCA and footprint work, and that it will make multi-disciplinary research happen by providing one common platform that helps answering questions from different areas.