

## Compiling and using input-output frameworks through collaborative virtual laboratories

Topic: Global MRIO Laboratory

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A Virtual Laboratory (VL) is a novel concept aimed at improving digital connectivity by connecting researchers to existing and new research facilities, data repositories and computational tools, and thus streamlining research workflows and enabling new opportunities for research innovation, more collaborative research, and new research efficiencies on a national scale. In Australia, VLs are created and administered under the lead of the University of Melbourne's NeCTAR project ([www.nectar.org.au](http://www.nectar.org.au)), and financed by the Australian Government's Education Investment Fund. NeCTAR Virtual Laboratories seek to support and engage major research communities in Australia by enabling research collaboration and research workflows across multiple research disciplines and problem-oriented research domains.

The Industrial Ecology Lab is one of NeCTAR's new Virtual Laboratories that targets a well-described, significant research challenge: in this case the compilation and use of a time series of Australian sub-national MRIO tables, set up within the University of Melbourne's NeCTAR Research Cloud.

Typically, every multi-region input-output MRIO application focuses on different research questions and therefore requires a good sectoral and regional resolution in different parts of an MRIO table. The innovation of this work – using input-output frameworks through collaborative virtual laboratories – addresses this limitation by applying a new concept to MRIO compilation: the “Mother” approach. The basic idea of this approach is to construct one MRIO table (the “Mother” table) that caters to the widest possible variety of research questions, and from which all existing MRIO tables (the “daughters”) can be derived. Eight Australian Universities and other organisations are part of this Virtual Laboratory (so-called developers), each of them providing their own data set to the Mother tables.

In the Industrial Ecology Virtual Laboratory, developer-specific ingredients such as raw data, concordances and constraints are gathered in a reconciliation engine that uploads the resultant Mother input-output tables into a designated repository. The reconciliation step can involve any of the procedures commonly applied, such as the construction of an initial estimate and a balancing algorithm. The VL will be made available to users from the Australian Research Community. It is equipped with an analytical toolbox that allows users to calculate derived quantities such as Leontief inverses, multipliers and environmental footprints, as well as with a facility to interrogate outputs and extract them in various formats. Finally, a user interface comprises a) a library of user-defined concordance matrices that can be used to transform the Mother table into any user-defined format, and b) libraries for storing user-defined inputs and outputs, enabling multiple users to work simultaneously on various individual research projects that may differ by which input data and/or reconciliation method is used. The entire workflow is handled within a cloud computing setting.