IELab Newsletter July 2021

Issue 4

Dear IELab Community

It’s been a long time since we sent out the last IELab newsletter and many exciting developments have taken place since. So here comes another edition. Read below about changes in the IELab computing infrastructure, new and updated datafeeds, new projects, IELab development in other countries, new publications and much more!

We hope you enjoy reading this newsletter and we'd love to get your feedback through the IELab Forum on the Hub.

Kind regards,
The IELab Team*)

Aus IELab hardware move and Portal rebirth

Three IELab servers at UNSW (Nina, Nana and Zeta) were decommissioned by UNSW IT but luckily found a new home at the School of Physics at the University of Sydney. The three servers were physically moved there and have now been reconnected to other IELab servers in the School (thanks to USyd for taking care of these valuable assets!).

The move forced the web server running the Aus IELab Portal to find a new host. After a longer than anticipated downtime, the Portal has been migrated to new infrastructure on the cloud (at AWS = Amazon Web Services).

Most prior functions of the Portal will remain the same with no action necessary from users to continue to use the platform. Access to built table data will now be handled in conjunction with the servers at USyd and will be available through a temporary link sent out by email.

Thanks to everyone for their understanding and patience during the move. Any annual subscriptions impacted by the migration will be extended by the downtime period. If you have any queries or issues with the migration, please contact the team at support@ielab.info.

New MRIO datafeeds tested

The ISA team at USyd (supported by UNSW) tested and updated existing datafeeds for the Aus IELab. These included the following data sources from the ABS (ABS Catalogue Number):

- Australian System of National Accounts (5204)
- Australian National Accounts: National Income (5206)
- Australian National Accounts: Input-Output Tables (5209)
- Australian National Accounts, Input-Output Tables, Product Details (5215)
- Australian National Accounts: Supply Use Tables (5217)
- Australian National Accounts: State Accounts (5220)
- Australian Industry (8155)

ISA also

- developed a tool called ‘Kite’ to perform automated testing of AusLab MRIOs,
- fixed bugs for imports and exports handling,
- added a timeseries option for the creation of nested MRIO tables (Aus IELab tables nested within Global IELab tables).

New satellite datafeeds

The ISA Team created new satellite datafeeds and updated existing ones. The following datafeeds have been integrated in the Global IELab: Corruption, Employment, Malaria, Nitrogen, OHS, Poverty, Gini, Water Scarcity, Phosphorus and Pesticide. In the Aus IElab, datafeeds for emissions and water were integrated.

Recent Aus IELab projects

UNSW and USyd have collaborated on a project commissioned by the Office of the Sustainability Commissioner of the ACT to calculate the carbon footprint of the ACT. A report will be presented to the Environment Minister of the ACT.

PhD student Kylie Goodwin at UNSW is investigating environmental footprints and planetary boundaries for Australian cities using nested MRIO tables where Australian regions are nested within global regions and countries.

Current projects at ISA/USyd include the work of PhD student Navoda Liyanapathirana on food systems, in collaboration with David Raubenheimer and Amanda Grech. More specifically, Navoda is using Nutritional Geometry to characterise meals, diets and foods of different processing grades according to their economic, social and environmental sustainability.

Master student Qiyu (Aaron) Liu, supervised by Arunima Malik, has coupled an Australian IO table to the MESSAGE Integrated Assessment Model (IAM). The ISA team have undertaken disaster input-output modelling for assessing the impacts of climate change on food supply chains in NSW. Arunima Malik and colleagues have quantified the carbon footprint of households in the Inner West Council. PhD student Amanda Irwin is looking at biodiversity impacts and forestry loss at an LGA-level.

Recent Global IELab developments

ISA, in collaboration with others, created a newly developed tool called NLab – "nested IELab" – that nests sub-national MRIO tables within global country-scale MRIOs. This capability allows for the investigation of interactions between sub-national production and consumption systems, with global systems interlinked via international trade. A paper was submitted to the Journal of Industrial Ecology.

A collaboration led by Manfred Lenzen used the Global MRIO Lab for compiling a tailored global MRIO data set, distinguishing 38 regions with 26 sectors each, to analyse the global socio-economic losses and environmental gains from the Coronavirus pandemic. The results have been published in the journal PloS One (see list of publications below).

USyd PhD student Yutong Jin is using the Global MRIO Lab to assess the effects of substituting crude-based plastics with bioplastics, in terms of greenhouse gas emissions, land use and employment.

Master student Elijah Tyedmers has used the Global MRIO Lab to evaluate a number of practical sustainability measures for the Cook Islands, such as local meat and beer, and a truck powered by vegetable oil. The findings are published in the Journal of Cleaner Production.

The Global IELab is being used by Arunima Malik and colleagues for assessing drivers of change in reactive nitrogen emissions over time, using structural decomposition analysis. Postdoc researcher Mengyu Li and colleagues have used the Global MRIO Lab to estimate the global carbon footprint of the global food freight task. PhD student Amanda Irwin is integrating a global biodiversity satellite account into the Global MRIOLab.

Jacob Fry started migrating the Eora national IO data into the Global Lab.

China Lab
Chinese IELab has implemented annually updated. Root classifications cover 2984 county regions in mainland China and 396 sectors consistent with Chinese ISIC standard (GB/T 4754-2002) for the year 2007. The benchmark is going to shift to the year 2017 with the releases of 2017 National Input-Output Survey, 2020 Population Census and 2018 Economic Census and the new Statistical Divisions and Chinese ISIC standard (GB/T 4754-2017) for the year 2017.

The constraints have been updated to 2019. The national GDP and provincial GDP from industrial valued added, income-sided and expenditure-sided perspectives have been covered periods of 1978-2019 and 1993-2019, respectively. The city GDP currently is only the total number for each city for over 200 cities with time series of 2004-2019. The satellite accounts including employment, energy and carbon emissions at provincial and industrial levels has been updated to 2019 from around 1997 for different indicators.

Chinese IELab currently can generate subnational MRIOs at city, provincial or grand regions (e.g., Urban agglomeration or Drainage basin in China) and also link with global MRIO tables from main stream databases such as Global IELab, Eora, GTAP, EXIOBASE, etc. by China Customs Statistics. PhD student Yutong Jin is currently conducting disaster analyses for regions in north-west China, as a result of ongoing desertification and water resources loss due to glacier melting. She has also published a material footprint study of four Chinese cities. Jacob Fry has shown how including increasing inter–industry information improves carbon footprints for China.

IndoLab
The Indonesia Minister of Finance, Dr. Sri Mulyani Indrawati, launched the Australia-Indonesia Virtual Lab, or "IndoLab" on 28 August 2019 in Jakarta. The IndoLab is a multi-disciplinary collaborative research platform modelled on the Australian Industrial Ecology Lab and developed by Dr. Futu Faturay, Prof. Manfred Lenzen, and Dr. Arne Geschke at the University of Sydney Australia (see Faturay et al., 2017).

The IndoLab Launch attracted many high-profile keynote speakers, such as Prof. Rina Indiastuti – Rector of Padjadjaran University Bandung, Prof. Suahasil Nazara – Chairman of Fiscal Policy Agency, Indonesia, Khanh Hoang – Director of National Accounts Benchmarks Australian Bureau of Statistics (ABS), Setianto – Director of Production Balance Statistics Indonesia (BPS), Janet Salem - Director of Resource Efficiency and Sustainable Consumption and Production, UNEP Asia & the Pacific, and Prof. Arnold Tukker – Professor of Industrial Ecology, Leiden University, Netherlands. The IndoLab has received grant funding from the Australia Indonesia Institute of the Australia Department of Foreign Affairs and Trade (AU$ 24,948), enabling the IndoLab to be popularized amongst Indonesian decision-makers.

USyd PhD student Janet Salem is investigating the inter-regional trade-offs within the Indonesian Archipelago in terms and materials and jobs.

Graduated PhD student Futu Faturay – the mastermind of the IndoLab – has conducted four disaster analyses for Taiwan, examining cyclones and earthquakes.

Japan Lab
USyd PhD student Navoda Liyanapathirana is currently investigating the production recipe of the Japanese tofu industry.

Graduated USyd PhD student Takako Wakiyama has used the Japan IELab for analysing regional food waste relationships.

Swiss Lab
The Swiss Lab was created by Dr Andreas Froemelt, ETH Zurich, in collaboration with ISA at USyd and SAP at UNSW. The root classification of the Swiss Lab (available online at http://stacks.iop.org/ERL/16/014018/mmedia) encompasses 794 sectors according to level 5 of the Swiss classification of economic activities (NOGA) and 2352 regions that accord to all Swiss municipalities as of 2014. Note that level 4 of NOGA equals the European classification NACE. According to the latest available Swiss input-output table (SIOT), the reference year was set to 2014 [56]. However, IELab together with corresponding constraints allows for computing time series.

Currently, Swiss official direct air emission accounts covering ten gases and two particulate matter categories are integrated in the SwissLab. The implementation of five different GHG categories (CO2 [fossil and biomass], N2O, CH4, and HFC/PFC/SF6) in SwissLab offers the possibility to provide policymakers with valuable information beyond total carbon footprints. For example, the varying effects of long-lived and short-lived GHG could be

considered to derive and prioritise different GHG mitigation policies.

An advanced model can be achieved by exploiting the advantages and overcoming the limitations of top-down and bottom-up approaches. The published article (see below), describes a highly detailed, spatially-resolved modelling framework that quantifies local activities and simultaneously analyses system-wide environmental and economic effects of planned interventions. It combined an existing, highly detailed bottom-up model for Switzerland (focusing on individual households) with a macro-economic top-down approach by developing a new Swiss sub-national, multi-region input-output model.

TaiwanLab
The TaiwanLab consists of a time series high resolution multi-regional input-output tables for Taiwan. The data includes 22 city/counties by 267 economic sectors from 1990 to 2016. Because of this unprecedent detail, the TaiwanLab is able to provide a comprehensive picture of Taiwan's regional economic structure, including regional economic distribution, sectoral contribution, inter-regional supply-chain flow, and structure changes over time. Combined with the employment satellite account, the TaiwanLab provides a valuable tool for impact evaluation and policy development.

The TaiwanLab is constructed based on a collaboration project between the University of Sydney in Australia and the National Cheng Kung University, Taiwan. The TaiwanLab has been adopted to support policy making and contribute to discussions of disaster management. It was first utilized by the Taiwan Forestry Bureau to evaluate the economic impact of visitor spending to National Forest Recreational Areas in Taiwan. Outputs provided a clear indication on how tourism development can benefit rural communities. The outcome was subsequently adopted by the Forestry Bureau for their decision to boost the investment on recreational facilities in order to maintain a sustainable tourist inflow. The second application assessed how natural disasters impact Taiwan's economy. Due to its geographic location, Taiwan frequently experiences severe earthquake and typhoon. Using four natural disasters (1999 Chichi earthquake, the 2009 typhoon Morakot, the 2016 Tainan earthquake, and the 2016 typhoon Megi) as examples, the study demonstrated the supply chain fragility, and provided important information to assist with damage mitigation, improve resiliency, and prioritize recovery schedules. The work is published in Economic System Research.

Arunima Malik is leading a study into supply chains of the Taiwanese electronics industry.

PhD student Navoda Liyanapathirana is currently investigating the production recipe of the Taiwanese vegan meat industry.

US IELab
US IELab (USLab) provides a Multi-Regional Input-Output (MRIO) database that can be used to study economic impacts of changes intended across the US economic system. The lab is being led by Assistant Professor Shweta Singh from Purdue University, USA. The USLab follows the same architecture as other IE labs and contains a time series of sub-national MRIO tables. The input data to the lab consists of national level IO tables as the starting point along with data for constraints on state level GDP and labor data. These national IO tables are then disaggregated to create the sub-regional MRIO tables based on non-survey approaches and constraints added to balance the sectoral and regional outputs.

The USLab can generate MRIO tables at several levels of regional and sectoral aggregation. Region options include 52, 9, and 5 regions corresponding to the 50 states plus Washington, DC and Puerto Rico, and two US Census Region levels, respectively. Users can tailor the MRIO sector aggregation to 21, 100, 312, 708, and 1,058 sectors, corresponding to NAICS codes, based on the disaggregation level required for their own analysis. The USLab is hosted on a server at University of Sydney and is accessed remotely to run analysis. The data required to build the USLab comes from the US Bureau of Economic Analysis (US BEA), that provides the national IO accounts and state GDP data, which are used as some of the constraints for disaggregation. Other optional constraining data include commodity flow survey, exports/imports, and consumer spending data. Using a time series or forecast of GDP, the USLab also provides a capability to generate a time series of US MRIO tables. Currently, data for years 2012-2017 has been included. To be able to use USLab, users should be familiar with Matlab and ALANG files that form the foundation of the IELab structure and the supply and use framework for constructing IO tables. This is the first MRIO Lab platform available for US that can use different non-survey methods to study the structural variations in MRIO tables.The lab has been used to study the economic impact of desired economic changes (such as renewable energy transition, low carbon economy etc.) in the US economy across all states along with satellite energy impacts. A satellite account of employment data from the Bureau of Labor Statistics' QCEW is also available. Currently, the capabilities are being expanded to perform GHG analysis by developing a satellite account that contains data on associated emissions for each sector.

Graduated USyd PhD student Futu Faturay has used the USLab for examining an expanding wind energy sector. USyd PhD student Navoda Liyanapathirana is currently investigating the production recipe of the US soy products industry.

For individual country IELabs, see also http://ielab.info/analyse.

New IELab publications

IELab researcher have now produced more than 100 publications, most of them journal papers!! These publications are either about IELab developments or have used IELab data.

The full list of 2020/2021 IELab publications is appended at the end of this newsletter. The full list is also available online at: https://ielab.info/citations/browse (or https://ielab.info/discover/publications).

From there, all citations can be exported in BibTex or EndNote format!

Australian State & Territory MRIO Table Timeseries

A new resource has been made available on the Hub containing subnational multi-regional input-output tables (MRIOs) for Australia, built using the IELab infrastructure. The model resolution is 8 sub-regions (Australian states and territories) at 25 sectors. The tables cover the timeseries 2009-2018. For each year, the model contains table for each margin layer: Basic prices, Trade margin, Transport margin, Taxes margin, Subsidies. Use of this model is governed by a creative commons attribution non-commercial license (https://creativecommons.org/licenses/by-nc/3.0/au/).

It can be found here for downloading and citation.

Aus IELab user fees

Operating and maintaining the IELab is associated with considerable costs. Even though the teams at UNSW Sydney and the University of Sydney manage to internalise some of these costs or compensate them with project funds, there still is a large funding gap which prevents us from operating IELab as professionally and smoothly as it should be.

For companies and consultancies, we have introduced a new premium option, which allows users to access updated data as soon as they become available (for details please contact us via info@ielab.info.

Option 1: Annual Individual Subscription (research only): $200
Option 2: Annual University or Government Department Subscription (1-5 users): $800
Option 3: Annual Additional University or Government Department Users (each): $200
Option 4: Annual Registration of Student Cohorts / Class Registrations: $800
Option 5: Annual Standard Consultancy or Company Subscription: $3000
Option 6: Annual Premium Consultancy or Company Subscription: $6000

Researchers should please continue to include future IELab user fees in any funding proposals they prepare!

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All users, please make sure you are subscribed to the IELab Forum!

APPENDIX – All IELab-related Publications

The full list of IELab publications is also available online at the hub's citations and publications.

Wakiyama, Takako, Lenzen, Manfred, Kadoya, Taku, Takeuchi, Yayoi, Nansai, Keisuke, (2021), "Forest Tax Payment Responsibility from the Forest Service Footprint Perspective", Environmental Science & Technology, 55, 5: pg: 3165-3174, (DOI: 10.1021/acs.est.0c04327)

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Malik, Arunima, Chandrakumar, Chanjief, Lenzen, Manfred, McLaren, Sarah J., (2021), "Re-Examining Climate Policies for Pathways to a Zero Carbon Future", Environmental Science & Technology, 55, 1: pg: 1-3, (DOI: 10.1021/acs.est.0c03424)

Fry, Jacob, Geschke, Arne, Langdon, Sarah, Lenzen, Manfred, Li, Mengyu, Malik, Arunima, Sun, Ya-Yen, Wiedmann, Thomas, (2021), "Creating multi-scale nested MRIO tables for linking localised impacts to global consumption drivers", Journal of Industrial Ecology, (forthcomin:

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Yu, Man, Wiedmann, Thomas, Langdon, Sarah, (2021), "Assessing the greenhouse gas mitigation potential of urban precincts with hybrid life cycle assessment", Journal of Cleaner Production, 279: pg: 123731, (DOI:

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Wiedmann, Thomas, Chen, Guangwu, Owen, Anne, Lenzen, Manfred, Doust, Michael, Barrett, John, Steele, Kristian, (2021), "Three-scope carbon emission inventories of global cities", Journal of Industrial Ecology, n/a, n/a: (DOI: 10.1111/jiec.13063)

Froemelt, Andreas, Geschke, Arne, Wiedmann, Thomas, (2021), "Quantifying carbon flows in Switzerland: top-down meets bottom-up modelling", Environmental Research Letters, 16, 1: pg: 014018, (DOI: 10.1088/1748-9326/abcdd5)

Akizu-Gardoki, Ortzi, Wakiyama, Takako, Wiedmann, Thomas, Bueno, Gorka, Arto, Iñaki, Lenzen, Manfred, Lopez-Guede, Jose Manuel, (2021), "Hidden Energy Flow indicator to reflect the outsourced energy requirements of countries", Journal of Cleaner Production, 278: pg: 123827, (DOI: https://doi.org/10.1016/j.jclepro.2020.123827)

Wang, Changbo, Malik, Arunima, Wang, Yafei, Chang, Yuan, Lenzen, Manfred, Zhou, Dequn, Pang, Mingyue, Huang, Qingxu, (2020), "The social, economic, and environmental implications of biomass ethanol production in China: A multi-regional input-output-based hybrid LCA model", Journal of Cleaner Production, 249: pg: 119326, (DOI: https://doi.org/10.1016/j.jclepro.2019.119326)

Heihsel, Michael, Lenzen, Manfred, Behrendt, Frank, (2020), "Desalination and sustainability: a triple bottom line study of Australia", Environmental Research Letters, 15, 11: pg: 114044, (DOI: 10.1088/1748-9326/abbd63)

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Pomponi, Francesco, Li, Mengyu, Sun, Ya-Yen, Malik, Arunima, Lenzen, Manfred, Fountas, Grigorios, D'Amico, Bernardino, Akizu-Gardoki, Ortzi, Luque Anguita, Maria, (2020), "A Novel Method for Estimating Emissions Reductions Caused by the Restriction of Mobility: The Case of the COVID-19 Pandemic", Environmental Science & Technology Letters, : (DOI: 10.1021/acs.estlett.0c00764)

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Ali, Syed Muhammad Hassan, Lenzen, Manfred, Sack, Fabian, Yousefzadeh, Moslem, (2020), "Electricity generation and demand flexibility in wastewater treatment plants: Benefits for 100% renewable electricity grids", Applied Energy, 268: pg: 114960, (DOI: https://doi.org/10.1016/j.apenergy.2020.114960)

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Faturay, Futu, Vunnava, Venkata Sai Gargeya, Lenzen, Manfred, Singh, Shweta, (2020), "Using a new USA multi-region input output (MRIO) model for assessing economic and energy impacts of wind energy expansion in USA", Applied Energy, 261: pg: 114141, (DOI: https://doi.org/10.1016/j.apenergy.2019.114141)

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