Development of Japanese flexible and highly detailed multi-regional input-output modeling framework

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Supply-chain management has become a critical issue in international politics and business as a way to identify and manage environmental, social and economic benefits and risks. In 2016, Sustainable Development Goals (SDGs) came into force where 17 sustainable development goals are set including climate change, biodiversity and sustainable consumption and production. To achieve the goal, various issues need to be considered and dealt with by covering promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Thus, a systemic approach and cooperation among actors operating in the supply chain, from producer to final consumer is required. From such circumstance, the following research question comes out: how we can manage enormous dataset and analyze such cross-cutting issues with various components to manage and identify environmental, economic and social benefits and risks.

This paper describes a flexible and highly detailed economic-environmental modeling tool that allows researchers to investigate the interdependencies of different economic structures in regions and areas at detail levels to answer given research questions - the Japanese Industrial Ecology Laboratory. The framework focuses on Japan, which is the world's second largest developed economy. The Japanese IELab is a collaborative virtual laboratory in which Japanese multi-regional input output databases can be created that will cover economic activities from national to city level in Japan. It will feature a highly flexible and spatial structure and function to facilitate the capability of an integrated analysis of life cycle assessment, carbon footprint, water footprint, ecological footprint and other approaches to environmental impact assessment.

As the methodology and data used for this paper, the development of the Japanese IELab will be achieved by integrating different source data, such as data of multi-regional input output (MRIO) tables, trade statistics, environmental statistics, and household expenditure statistics, into a harmonized data processing framework. The Japanese IELab will use the data processing engine developed for the Australian IELab in order to harness the abundance of information provided by different source data sets. The source data sets will contain information of the following type: regional level data including income, production and employment data, sub-sectors of energy, material, water, transportation, industry, and agriculture and forestry, and inter-regional trade across different prefectures and cities. The novelty of this research is that, following the integration of all these source data sets, the Japanese IElab will be the most comprehensive and detailed data set for economic activities in Japan.