An Input-Output approach for the assessment of sustainability transitions

Topic: Energy and Sustainable policies
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Achieving the urgently needed transition to sustainability is the biggest challenge of humanity today. Addressing such challenge calls for a profound understanding of the complex dynamics of social-ecological systems, where economic, social, and environmental dimensions interact with one another and impact each other. Recognizing the interconnectedness of these dimensions, it is clear that the assessment of how different economic activities contribute to or hinder such sustainability transitions demands a nuanced, multi-dimensional approach, commonly known as the nexus approach (Liu et al., 2018). This methodology involves the simultaneous consideration of economic, social, and environmental factors, unraveling both synergies and tradeoffs from different policies, activities, and strategies.
Building upon the established usefulness of Input-Output (IO) models in capturing economic influences across dense economic structures, and connecting production sectors and consumer products with several social and environmental indicators (extended models), including entire supply chains, this research picks up and expands the discussion on the applicability of IO for the assessment of sustainability transitions. To that end, the study addresses the following four research questions:
a) To what extent current IO models are suited for nexus analyses that can assess and monitor sustainability transitions; particularly in decisive and transversal economic systems such as the food and energy systems? This question is addressed through an updated literature review in view of the fast-expanding IO literature. The focus on food and energy systems responds to their pivotal role in the overall sustainability landscape, and their influence in many other sectors.
b) How can IO frameworks be adapted to better capture the complexities of social-ecological systems underpinning sustainability transitions through circular and bio-economy practices? Here, the study delves into the possible modification of IO frameworks based on the strengths and weaknesses of existing IO models that were identified when answering the previous question. This section of the article reflects the authorâ€™s commentary and perspective.
c) What are the some of weaknesses, strengths, limitations, data needs, and further research of using the proposed modified IO framework for sustainability assessments? This section, also based on the authorâ€™s perspective, discusses the strengths, weaknesses, limitations, data requirements, and further research needed, with respect to the adapted IO framework mentioned in the previous question.
d) How does the application of the proposed IO model compares with other common analytical approaches in terms of providing a more complete picture of sustainability? This last section, seeks to illustrate via a simple practical example the difference between the proposed model and current and traditional methods, thus showcasing how the former provides a more comprehensive understanding of sustainability. To the example uses data from statistical databases, such as the Eora Global Supply Chain Database (MRIO).
The novelty of this work lies in the exploration, discussion, and proposal of applying and adapting IO methodologies to assess important contemporary issues, such as the dynamics of social-ecological systems, nexus analyses, and sustainability transitions with a specific focus on food and energy systems, and circular- and bio-economy paradigms. In this way, the study aims to contribute to the ongoing discourse on tools to implement and monitor sustainability transitions, and to the development of robust analytical frameworks that can therefore guide decision making in our complex reality.

Liu, J., Hull, V., Godfray, H. C. J., Tilman, D., Gleick, P., Hoff, H., ... & Li, S. (2018). Nexus approaches to global sustainable development. Nature Sustainability, 1(9), 466-476.