Principles and promise of network theory and its application to EIOA and related industrial ecology tools

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Networks have been an important object of study the last decade or so. The mathematical theory of networks is much older, but the rise of computer power has spawned new algorithms, new network indicators and new insights. Moreover, the availability of data in a variety of fields has yielded important information on the similarity of networks in different topics. Network studies have been conducted on, amongst others, social relationships (friendships), internet architecture (hyperlinks on webpages), dispersion of infectious diseases, citation networks (articles citing other articles), trophic structure of ecosystems, and neural activity (supported by modern imaging techniques).

Network theory is able to answer important and new questions, such as those relating to stability and speed of information transmission. The theoretical developments of network theory as a general theory, like systems theory and statistics, help to apply it to dedicated problems in the area of IOA including EIOA, life cycle assessment, industrial ecosystems, and other tools in industrial ecology and sustainability science. The presence of huge datasets, such as EXIOBASE and ecoinvent, and the availability of efficient algorithms and fast computers further enable the study of network theory for EIOA and related tools.

This paper reviews the potential of network theory in EIOA and related industrial ecology tools. The main purpose of the paper is to propose a framework for applying network theory to EIOA, with extensions to other tools.