

# Researchers examine 'nestedness' of industrial ecosystems

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(Phys.org)—Biodiversity is a complex phenomenon that emerges from the combination of a large number of ecological mechanisms. Yet, despite the complexity of its origins, there is one prevalent pattern that always appears to emerge. This is a pattern known as "nestedness," which is expressed in the fact that the less ecologically diverse locations tend to be populated by subsets of the species present in the most ecologically diverse locations. Hence, biological ecosystems are characterized by an emergent order in which there is little evidence of specialization, since the rare species locate only in places that are already inhabited by many others.

But does this apply to industrial ecosystems? Are these also nested? In other words, are the industries in Springfield, MA a subset of those found in Boston? And, are the exports of Argentina a subset of those of the United States? A paper published this week in [PLoS ONE](#), using data on both international and domestic economies, shows that this appears to be the case. The paper shows that, just like biological ecosystems, economies are highly nested, and that these mimic the patterns of the ecological networks found in nature.

The study looks at decades of exports data for the entire world, and at four years of Chilean tax records, to study the nestedness and evolution of these networks. Moreover, the researchers show that the nestedness of these networks tends to be conserved over time, despite a substantial increase in [diversification](#) during the observation period. This implies that the appearance and disappearance of industries follows a

non-[random pattern](#) that keeps the nestedness of the studied industry location networks largely unchanged.

The research explores two implications of nestedness. First, the researches leveraged the fact that nestedness is conserved to create a simple statistical model that can predict the appearance and disappearance of industries at locations. For example, they found that industries that are unexpected to be at a location based on the nestedness of the network are more likely to disappear than those that are expected according to the nestedness of the network. By the same token, industries that are expected to be in a location, but are not, are more likely to appear than those that would imply a large deviation from the observed nested pattern.

The study also looks at the theoretical implications of nestedness by using a model of industry locations networks. The researchers found that the model is able to account for both—the nestedness of the network and its dynamics.

"Understanding the evolution of industrial ecosystems is important because the mix of products that a country exports is one of the strongest leading indicators of long-term economic growth" says professor Hidalgo, senior author of the study and director of The MIT Media Lab's Macro Connections group. "This paper shows that the evolution of industrial ecosystems follows patterns that have an important degree of predictability, and hence, demonstrate a fundamental constrain on how we expect the world economy to evolve during the coming years. Moreover, the fact that these patterns can be explained by a simple [statistical model](#) raises doubts about whether rational decision making is needed to explain macroeconomic patterns like the ones uncovered in this paper."

More research will be needed to establish the mechanisms that are

common to both ecology and economics, and that give rise to the nestedness observed in both types of ecosystems. The results of this paper suggest, however, that the world economy mirrors nature in this regard.

**More information:** Bustos S, Gomez C, Hausmann R, Hidalgo CA (2012) The Dynamics of Nestedness Predicts the Evolution of Industrial Ecosystems. *PLoS One* 7(11): e49393.  
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