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Applying economic complexity to agriculture: new indicators for water security

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The application of complex network theory to economics has given the chance to define the hidden capabilities (i.e., natural and human resources, investments, finances, etc.) of production of countries whose economic growth is determined. This application is known as economic complexity and it evaluates the hidden capabilities of production by exploiting the data on the international trade of goods. The outcomes of the economic complexity methodologies are a ranking of the countries, according to their economic growth potential, and a ranking of the products, according to the capabilities required for their production and export (more sophisticated products require more capabilities).

The idea lying beyond the economic complexity framework is replicable and it can be effectively used in other fields beyond economics. A first example is ecology, where the approach is used to rank the species interacting in an ecosystem. A second example is eco-hydrology, where the methodologies of economic complexity have been used to rank countries according to their virtual water consumption.

Here, we propose to exploit the approach of economic complexity to define a ranking of countries according to the sustainability of the water used in agriculture. For each country, we define the amount of blue water used for irrigation, categorized according to the sources of water withdrawal (i.e., groundwater or surface water discretized with different thresholds depending on the rechargeability of the sources). To structure the data as a bipartite network of countries-sources allows one to rank countries according to the impact of their agriculture on the global water resources, while ranking the sources of blue water for their sustainability. In this view, less valued water sources – in the sense of being more rechargeable – are found at the bottom of the ranking, while more valued water sources, as the fossil ones, are found at the top positions. Our results reveal the performance of countries in terms of their water management strategies. This approach could pave the way to a new class of indicators of water security and management that could help policy makers in the definition of new strategies for granting water security on a global scale.