ECOLOGICAL ECONOMICS

Moving away from sustainability

Historical and future trends in sustainability performance show that the world's countries have substantially overshoot their fair share of most planetary boundaries, without proportional social achievements.

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The doughnut-shaped Safe and Just Space framework describes the need for attaining minimum social standards while also limiting pressure on the planet¹. By assembling both social and planetary boundaries as two concentric radar charts², it challenges the received economic wisdom that seeks endless growth without considering the Earth's biophysical limits. The framework is useful to monitor (un)sustainable trends and calls for a new development model in which social shortfall and ecological overshoot are eliminated simultaneously. The Doughnut framework has succeeded in fuelling an interesting and necessary discussion on the sustainability performance of cities, regions, nations and the world^{3,4}. Previous research has shown that no country satisfies its social requirements in an environmentally sustainable way, but the historical and future trends in sustainability performance of the world's nations were unknown. Writing in this issue, Fanning and co-authors⁵ tracked the sustainability performance of over 140 countries in the period 1992–2015 and conducted a projection of current trends to 2050.

To provide a clear and consistent picture of the world's social progress and ecological degradation over time and space, Fanning et al. traced the trajectories of 11 social and six biophysical indicators (Fig. 1), informed by the Doughnut framework. They found that, on the global scale, eight out of ten social objectives are yet to be achieved, while five out of six planetary boundaries had been transgressed as of 2015. In 1992, the proportions were 90% and 67%, respectively. At the national level, 25% of the countries have failed to fulfil half of the social objectives while overshooting half of the biophysical boundaries, downscaled from the planetary-scale value to a per capita share. Generally, countries that exhibit good performance on social achievement do not operate in an environmentally sustainable way, while environmentally sustainable ones suffer from serious social shortfall.

In addition to understanding which countries transgress the two sets of

boundaries, the work also focuses on the extent of ecological overshoot and social shortfall. Overall, ecological overshoot increases faster than the decrease in social shortfall. Although two countries (Uzbekistan, and Trinidad and Tobago) seem to have approached the safe and just space between social and planetary boundaries, none has managed to reduce social shortfall without exacerbating biophysical exploitation. This finding is highly policy relevant, particularly for those economies that have transgressed all of the biophysical boundaries, because once a society transgresses all biophysical boundaries, monitoring the extent of this overshoot becomes urgent.

The outlook is challenging. To contribute to early warning and precautionary approaches, Fanning et al. also predicted possible trajectories for the countries' social–ecological systems. By analysing time-series data on both biophysical and social indicators for all of the countries in the period 2016–2050 (Fig. 1), they find that, if historical trends continue, in 2050 the number of countries transgressing biophysical boundaries will increase by 10–27% for nitrogen, ecological and material footprints, and land-system change and by 40% for carbon emissions. As for the social indicators, while 63% of countries would achieve at least one additional social objective, there are four objectives that 72% of countries will not be able to achieve, which include life satisfaction, social support, democratic quality and equality.

A major contribution of the research by Fanning and colleagues is that it bridges science and policy to open a new way of tracing and projecting the sustainability of social–ecological systems. Future studies can build on and extend this to consider the following issues. First, the Sustainable Development Goals approved by all member states of the United Nations provide a systematic and comprehensive means of setting goals and indicators that contribute to sustainable well-being⁶ and can therefore serve as a reference to update the social

and biophysical indicators employed by this study. Second, interactions within and between the various biophysical processes and social responses have been found to be ubiquitous, complex and dynamic^{7,8}. The COVID-19 pandemic is probably one example of social disruption associated with long-term ecological overshooting. Therefore, taking these interactions into account is a promising next step. Third, both the biophysical and social indicators can experience dramatic changes derived from nonlinear dynamics and thresholds⁹. Such nonlinearities can hardly be anticipated using ordinary statistical models based essentially on historical data. One way to improve prediction is to combine scenario analyses with data-driven technologies, such as data mining and machine learning algorithms¹⁰.

Human societies have a tradition of aiming to maximize welfare within planetary boundaries. For example, the traditional Chinese philosophy 'harmony between humans and nature' (*tian-ren-he-yi*) emphasizes the need for humankind to coordinate their activities with the environment. However, the research by Fanning et al. suggests the opposite: we are moving away from, not towards, sustainable societies, after decades of sustainability education and initiatives worldwide. Each of the social objectives is fulfilled at the cost of overstepping one or more additional planetary boundaries, and countries have already transgressed most, if not all, of the boundaries before achieving most social objectives. Moreover, this trend is likely to remain unchanged or to worsen if no immediate, radical transition activities are implemented. Concluding that current trajectories are neither environmentally sustainable nor socially sufficient from the Doughnut perspective, the authors deepen our understanding of how ecological overshoot would eventually offset social achievement. These findings are disappointing indeed, but not making any changes would be even more so, and potentially catastrophic for humanity. □

Fig. 1 | Changes in the national sustainability performance relative to social objectives and biophysical boundaries. a,b, Summary of the data⁵ for 148 countries from 1992 to 2015 (**a**) and 2016 to 2050 (**b**). Blue and red cells represent positive and negative changes in indicators, respectively, and white cells indicate that no data were available. For social indicators (S), the changes are calculated as $\Delta S = \log \frac{S_{2015}}{S_{1992}}$ (**a**) and $\Delta S = \log \frac{S_{2050}}{S_{2016}}$ (**b**); for biophysical indicators (B), the changes are calculated as $\Delta B = \log \frac{B_{1992}}{B_{2015}}$ (**a**) and $\Delta B = \log \frac{B_{2016}}{B_{2050}}$ (**b**).

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Competing interests

The author declares no competing interests.