

From bytes to sustainable: assessing the environmental and socioeconomic footprints of the global digital industry

Topic: Input-Output Analysis: Sustainable Production and Consumption policies (4)

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The rapid growth of the digital industry drives uneven global environmental and socioeconomic impacts, underscoring the need for comprehensive supply-chain assessments to guide sustainable digitalization. Using a multi-regional input-output model, we present a supply-chain-based quantitative evaluation of the digital industry's impacts on 12 SDGs across 164 economies from 1995 to 2021 and analyze the balance between economic benefits and environmental costs. We find that the digital industry contributed over 6% to global socioeconomic development but less than 6% to environmental impacts. However, substantial shares of air pollutants (4.8-5.9%) and mineral resource use (3.3-4.5%) highlight the need for sustainability strategies beyond decarbonization. Digital manufacturing dominates environmental footprints, while service-oriented sectors have expanded rapidly since 2015. Environmental and social burdens are concentrated in high-middle SDI economies, whereas high-SDI economies capture the majority of economic benefits. This imbalance is reflected in global Gini indices above 0.4, indicating substantial inequality in how digital industries distribute environmental costs and economic gains. Since 2008, high-SDI economies have decoupled growth from environmental harm, while low- and middle-SDI economies face increasing environmental pressures. Structural decomposition analysis shows that between 2008 and 2021, the contribution of output expansion to environmental growth fell to below 9% per year. Improvements in environmental intensity and production structure, particularly in higher-SDI regions, further reduced global environmental impacts. These findings highlight the urgent need for broader environmental indicators in evaluating digital sustainability and the importance of strengthening supply-chain mitigation measures across the digital industry.