

Bridging the circularity gap: a conceptual framework for measuring the biological cycle of the circular economy

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Abstract

The Circularity Gap Report 2025 reveals a troubling decline in global material circularity—from 7.2% in 2023 to just 6.9% in 2025—highlighting the widening *circularity gap*, where resource consumption increasingly outpaces recycling efforts. While this metric has advanced global awareness of material use, it primarily reflects the technical cycle, leaving the biological cycle marginally explored. Yet biological resources are central to regeneration, nutrient cycling, and the long-term sustainability of the circular economy. Current academic work on measuring biological circularity remains fragmented, with most indicators focused on biomass use volumes or ecological footprints, rather than the integrity of underlying cycles. This presentation introduces a conceptual framework to advance this field by structuring how the biological cycle can be represented within circularity metrics. Building on material flow analysis (MFA), it outlines pathways for tracking biomass production, extraction, use, reintegration, and losses, and for linking these to land-use change, non-renewable inputs, and nutrient balances. It proposes indicators to capture regenerative sufficiency, potential returns to ecosystems, and contributions to maintaining cycle integrity. By embedding ecological thresholds and planetary boundaries into circularity assessment, it aims to expand the paradigm beyond recycling-focused metrics and to catalyze future research, policy strategy, and reporting in the emerging circular bioeconomy.

Short CV

Claudia Patricia Pabón Pereira, PhD is an Assistant Professor of Circular Economy and Sustainable Business at the Business School and Institute for Sustainable Development of Pontificia Universidad Católica de Chile. She holds a PhD and MSc in Environmental Sciences from Wageningen University (Netherlands) and a degree in Industrial Engineering from Pontificia Universidad Javeriana (Colombia). Her expertise lies at the intersection of circular economy, environmental technologies, and sustainable business models, with a focus on metrics and strategies that enable the transition to regenerative systems. She has over 20 years of experience in teaching, research, and consultancy across Latin America and Europe, and has advised municipalities, ministries, and international organizations on circularity, resource recovery, and policy design. She is also the inventor of a patented compact biodigestion system for urban organic waste valorization.

Beyond academia, Dr. Pabón Pereira is enthusiastic about bridging science and practice. She served as Senior Advisor on Global Circularity Metrics at Circle Economy (Netherlands) and is founder of Traesure, a consultancy dedicated to circular innovation, technology, and education. Her work spans from applied research on anaerobic digestion and biomass valorization to the development of circular business models and national strategies. She has published extensively in peer-reviewed journals, contributed to international policy documents, and regularly speaks at global forums on circularity and bioeconomy transitions.