

Towards Relational Design:

Understanding Complexity and Failure in Circular Innovation Ecosystems

Abstract

This monograph investigates how systemic design can, and often cannot, foster cooperation, relational capacity, and cross-sectoral integration among actors engaged in local circular economy (CE) transitions. Despite the emergence of CE as a leading sustainability framework in European policy and research, persistent gaps remain between its collaborative aspirations and the structural realities of multi-stakeholder practice. Situated within the NODES (Nord Ovest Digitale e Sostenibile) innovation ecosystem in Piemonte, Italy, the research originated from a concrete objective: to co-design a digital platform enabling industrial symbiosis among regional actors. Encountering the structural realities of a complex innovation ecosystem revealed, however, that collaboration cannot be assumed or guaranteed by tools and methods alone.

The main research question is: how can systemic design foster cooperation, relationships, and integration among actors to develop and sustain a local circular economy? The study employs a predominantly qualitative, design-led methodology combining three iterative thematic literature reviews; a comparative mapping of 101 European digital platforms for industrial symbiosis; semi-structured interviews with experts across practice, policy, and academia; and four co-design workshops using systemic mapping and boundary objects. Epistemologically, the research draws on social constructivism as arrived at through Latour's Actor–Network Theory (2005) and Haraway's situated knowledges (1988), with Systemic and Participatory Design treated as complementary epistemic frameworks.

The principal empirical finding is that organisational rigidity, hierarchical governance, short project-based funding cycles incompatible with relationship-building, and unequal power relations within the NODES/GRIP ecosystem prevented genuine participatory collaboration from taking hold. Rather than treating this outcome as a methodological failure, the thesis proposes a constructive theory of participatory failure, drawing on critical visualisation theory (Hall & Dávila, 2022) and boundary objects (Star & Griesemer, 1989) to reframe breakdown as a diagnostic lens. This reframing makes visible the systemic frictions, institutional inertia, misaligned incentives, vertical disciplinary silos, and limited relational infrastructure that shape circular transitions but are typically obscured in accounts of successful implementation. The thesis concludes that structural, relational, and institutional conditions must themselves become objects of design inquiry, and contributes a critical framework for understanding why participation fails and what enabling conditions are necessary for sustained circular collaboration to emerge.