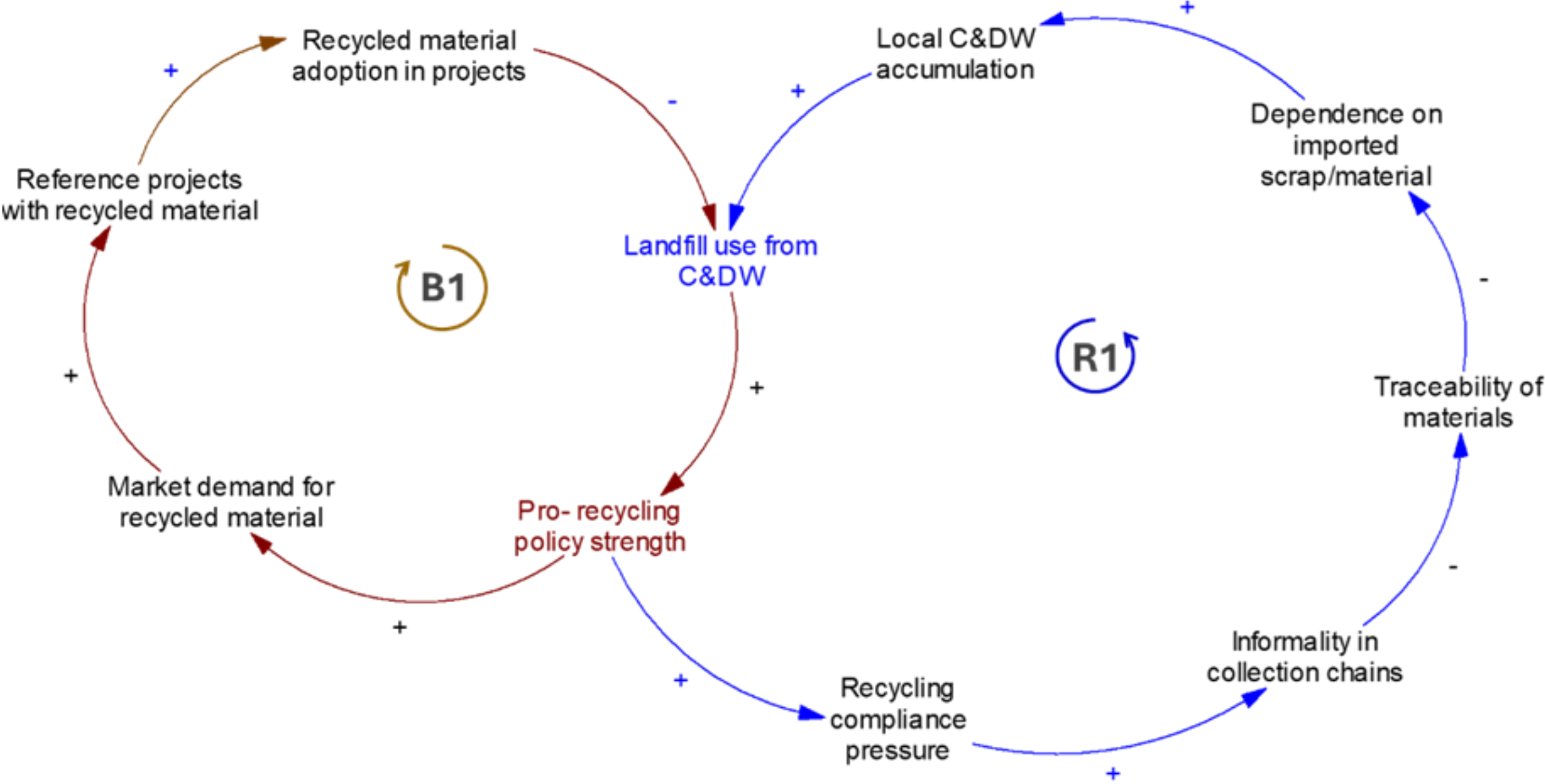
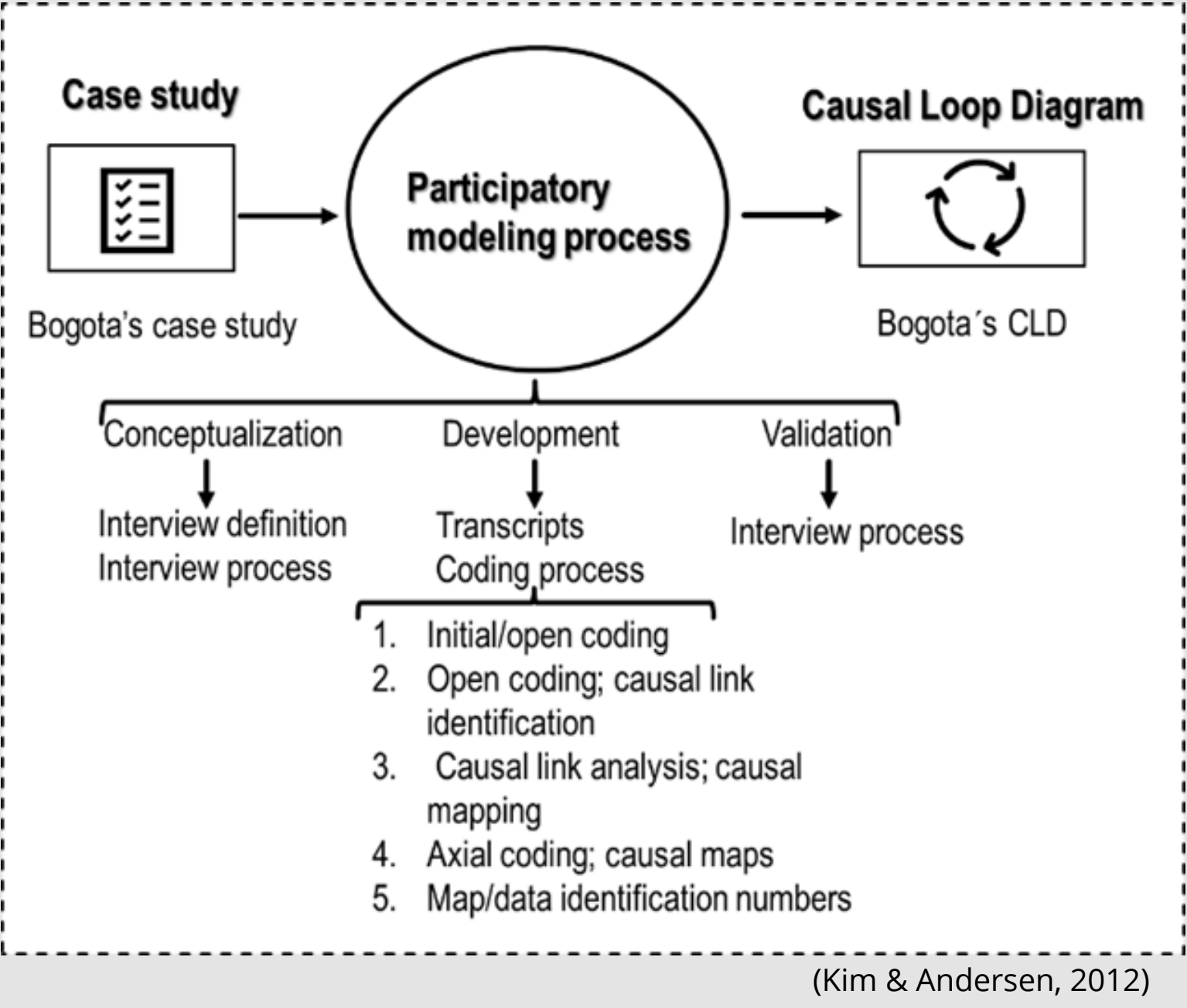


CIRCULAR CONSTRUCTION IN BOGOTÁ: UNDERSTANDING TRANSITION DYNAMICS



METHODS



ABSTRACT

Purpose. Circular economy policies in the construction sector increasingly promote recycling to reduce landfill use and material extraction. In Colombia, these policies have intensified the use of recycled materials, particularly in steel and construction supply chains. However, their broader systemic effects remain insufficiently understood. This study examines how pro-recycling policies interact with existing material supply chains and market structures, generating unintended consequences that challenge local circularity outcomes.

Methodology. The study applies a system dynamics approach based on participatory modeling, drawing on established methods for eliciting and structuring stakeholders' mental models in the system dynamics literature. Semi-structured interviews and participatory sessions with industry and public-sector actors informed the development of a causal loop diagram capturing key feedback mechanisms related to construction and demolition waste, recycling practices, material sourcing, and policy responses.

Findings.

The analysis identifies a reinforcing feedback loop in which strong recycling mandates, combined with informal recycling systems, weak traceability, and limited local standards, increase reliance on imported certified recycled materials. While this behavior facilitates regulatory compliance and reduces reported landfill use, it simultaneously weakens local recycling markets, increases the accumulation of unused local construction and demolition waste, and reinforces dependence on external supply chains.

Value. By making these feedback structures explicit, the study highlights how well-intentioned circular economy policies can produce policy resistance and unintended outcomes. The findings demonstrate the value of system dynamics for diagnosing structural challenges in circular economy implementation and for supporting more context-sensitive policy design in emerging economies.

"I work in a steel company... and honestly, what we feel every day is pressure to comply with the circularity rules...you have to show that part of your production uses recycled material. That's it.The problem is that recycling here is still very informal. Collection, sorting, all of that... it's messy. You get material from different places, different people, and many times you don't really know where it came from or how it was handled. So... even if we want to use local recycled material, it's hard to prove it properly. And when audits come, they don't ask how hard it was, they just ask for documents. Because of that, a lot of companies start looking for other options. For example, importing recycled scrap. It comes with certificates, paperwork, everything is clear...I don't think anyone is trying to do the wrong thing. We're just trying to comply..."

In vivo codes: "Pro-recycling policy"; "Pressure"; "Informality"; "location, price, and certifications", "imported materials", "local accumulation"

Analytic codes: Pro-recycling policy → logistics pressure → informality in recycling chains→ certification of materials → Imported materials → Construction and demolition waste accumulation → landfill use→ Pro-recycling policy