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Circular economy in international trade: challenges and opportunities for global value chains

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1 Introduction

The circular economy (CE) seeks to decouple growth from environmental degradation by closing material loops and promoting reuse, repair, and recycling. While CE has gained increasing traction at the national and regional levels, particularly in policy frameworks like the European Green Deal, its global integration through international trade and global value chains (GVCs) remains limited and fragmented. As economies seek to minimize waste and extend the lifecycle of materials, international trade becomes a crucial enabler, or barrier, to the realization of circularity on a global scale (Tuerk and Sporysheva, 2022). In recent years, the global policy discourse has acknowledged the potential of circular trade to reduce raw material dependency, promote eco-innovation, and support just transitions toward more inclusive economic models (Srivastava, 2024).

However, the interface between CE and international trade remains underexplored in mainstream sustainability research. While studies have empirically assessed the trade effects of circular material use in specific sectors (de Lange, 2024) and modeled waste flow dynamics globally (Zisopoulos et al., 2025), less attention has been paid to how stakeholders—governments, trade organizations, firms, and civil society—shape and are shaped by regulatory misalignments, fragmented standards, and trade classifications that obstruct circular material flows. Recent reviews also emphasize that successful CE integration requires not just technical adaptation but also coordinated stakeholder engagement to overcome regulatory uncertainty and market barriers (Onukwulu et al., 2025; Singh and Kumar, 2024).

This reveals a clear research gap: the lack of conceptual and policy-oriented analyses that examine how specific stakeholder interactions and trade mechanisms constrain or enable circular transitions across borders.

Moreover, scholars are increasingly recognizing that without international trade reform, many CE strategies risk being confined to national borders, undermining the potential for large-scale circular transitions (Šálková and Singh, 2024). The global dimension is particularly crucial when considering how circularity can drive social inclusion, particularly through circular supply chains that generate jobs and redistribute value (Van Opstal et al., 2024).

While existing research has addressed various dimensions of the circular economy and trade separately, few studies have explored how specific stakeholder interactions intersect with trade policy mechanisms to enable or constrain circular transitions across borders. Moreover, most existing literature focuses on either sector-neutral frameworks or technical barriers, with limited attention to how governance misalignments and

classification systems affect CE in globally integrated sectors. This article fills this gap by offering a stakeholder-sensitive and sector-specific review, highlighting the roles of governments, firms, trade organizations, and civil society in shaping circular trade. Article contribute a novel perspective by combining policy analysis with cases from the textile and construction sectors, and by offering actionable trade-related policy recommendations to support a more inclusive and harmonized global circular transition. The findings suggest that international trade policy, if strategically reformed, can evolve from a barrier into a key enabler of circular value chains. This has direct implications for policymakers seeking to align trade, sustainability, and industrial development goals.

2 Circular economy and trade: points of tension and synergy

At the heart of CE model lie three core principles: designing out waste and pollution, keeping materials in use, and regenerating natural systems. However, the circular economy is more than just a technical redesign of industrial processes, it entails a structural transformation of economic systems, including the creation of new business models, shifts in producer-consumer dynamics, and the development of collaborative industrial ecosystems (Awan et al., 2022). As production and consumption are globally distributed, international trade is essential for enabling circular flows of second-hand goods, remanufactured products, and secondary raw materials. These exchanges reduce reliance on virgin resources and expand access to technologies and services needed for circular models. Van Der Ven (2020) adds that circular trade also supports inclusion by creating jobs and promoting reuse of high-value goods. However, many circular products are misclassified as waste, causing delays (Adebayo et al., 2024), import bans, and compliance uncertainty due to the lack of harmonized definitions and standards (Jaswal, 2021). This disproportionately affects developing countries, where large volumes of used goods can strain local industries and waste systems, raising concerns about equity in global circular trade (Barrie et al., 2022).

GVC organize production across multiple countries and have driven specialization and economic growth. However, they also contribute to environmental harm due to long-distance transport and weak regulatory coherence. Embedding circularity into GVCs offers major sustainability benefits. It reduces reliance on virgin raw materials, supports innovation in recycling and product design, and strengthens supply chain resilience by diversifying sourcing options and lowering material risks (Eisenreich et al., 2022). However, achieving this transformation requires several systemic enablers: harmonized environmental standards across borders, interoperable systems for tracking and exchanging value chain data (Gentilini et al., 2021), and policy coherence across trade, industrial, and environmental governance structures (Tuerk and Sporysheva, 2022). Without these supporting conditions, the integration of CE into international trade and GVCs will remain partial and inconsistent, undermining its potential as a driver of sustainable globalization.

Sector-specific challenges further complicate the picture. In the automotive sector, remanufacturing has significant environmental and economic potential but struggles with limited consumer

trust, inconsistent regulations, and a lack of demand certainty. Public procurement has been identified as a promising lever to create stable markets for remanufactured parts (Wasserbauer et al., 2022). In electronics, trade in refurbished goods is often blocked by strict product safety or data security laws. In textiles, second-hand clothing exports raise both environmental and socio-economic issues in importing countries, while in construction, the lack of performance standards for reclaimed materials hinders international flows despite high sustainability potential (Huovila and Westerholm, 2022).

Technical and regulatory trade barriers remain a persistent obstacle. A more supportive global trade regime for circularity could be built by standardizing customs classifications for circular goods, harmonizing environmental quality standards, and embedding circularity into trade and investment agreements. The WTO could play a greater role (currently lack clarity regarding remanufactured products leading to trade disputes and reduced market trust) by facilitating rule updates, promoting transparency, and enhancing the integration of circular economy goals into its Committee on Trade and Environment. Simultaneously, regional trade agreements can serve as testbeds for mutual recognition of CE standards and capacity-building programs aimed at developing economies (Barrie and Schröder, 2021). National and regional policies such as China's National Sword initiative or specific interpretations of the Basel Convention have restricted the flow of recyclable materials and waste, disrupting global secondary materials markets (Do et al., 2020).

3 Sectoral focus

Among the many sectors impacted by the transition to a circular economy, the textile and construction industries stand out due to their scale, environmental footprint, and strategic roles within global value chains. Both are resource-intensive, trade-dependent, and generate substantial waste, yet they also offer distinct opportunities for circular innovation. These sectors are used here as diagnostic cases that illustrate how systemic barriers, such as regulatory misalignments, fragmented standards, and stakeholder coordination gaps, affect the global implementation of circular principles. Their analysis reinforces the article's core argument that trade policy can either enable or obstruct circular transitions across borders. The textile industry, as one of the most globalized and environmentally intensive sectors, it contributes heavily to resource depletion, emissions, water use, and waste (Das et al., 2025). Over 100 billion garments are produced annually, with only around 15% collected for reuse or recycling, and even less transformed into new products (Shirvanimoghaddam et al., 2020). The linear model of "produce, consume, discard" is reinforced by global trade: production is concentrated in low-cost countries, while consumption and disposal occur mainly in high-income regions. This disconnect undermines accountability across the value chain. However, strategies like extended producer responsibility, textile-to-textile recycling, and second-hand trade are gaining traction in both policy and industry.

Research increasingly calls for system-level change over technical fixes. A cross-national study in the Netherlands, Spain, and India co-developed future scenarios showing that circularity

must also address labor rights, gender equity, and informal work to ensure just transitions (Suarez-Visbal et al., 2024). In the Dutch context, second-hand flows are most developed, mechanical recycling suffers from weak demand for recycled fibers, and chemical recycling remains costly and experimental (Reike et al., 2023). These differences show that CE success hinges not only on technology but also on regulation, market incentives, and consumer perception. At the firm level, companies like Riopele in Portugal demonstrate that CE integration is feasible through waste valorization, stakeholder collaboration, and institutional partnerships, despite barriers such as high upfront costs (Barros et al., 2022). Yet, at the trade level, second-hand clothing exports remain controversial. While they extend product lifespans, they may also undercut local industries and foster dependency. As a result, several African nations have moved to ban or limit such imports. These tensions highlight a core dilemma of circular trade: how to align global material flows with local development goals. The textile sector reflects both the systemic barriers and enabling conditions of cross-border circularity. Without harmonized standards, inclusive business models, and coordinated policies, circularity in textiles risks remaining fragmented and unjust. The textile sector exemplifies how international trade rules shape circular outcomes, revealing that without regulatory coherence and socially inclusive models, CE objectives may falter.

The construction industry accounts for roughly 40% of global material use and over one-third of total waste generation. As urbanization accelerates, its environmental impact grows, making circular strategies like modular design, material reuse, and deconstruction increasingly relevant. However, uptake remains limited due to regulatory uncertainty, fragmented supply chains, and trade-related constraints. Construction materials often cross borders, particularly in the case of steel, cement, glass, and prefabricated modules. Yet, reused and recycled materials frequently face stricter import rules than virgin ones, due to outdated safety codes and the lack of harmonized standards. Building regulations often overlook environmental performance, and customs codes rarely differentiate between recycled and new inputs. This hinders trade and prevents reliable data collection on circular flows. Research emphasizes that circular transformation must start at the design stage. Material choices, modularity, and disassembly planning determine whether a building can be reused or recycled. Current value chains remain highly linear, with low feedback between actors, poor reuse rates, and continued reliance on primary resources (Huovila and Westerholm, 2022). Systemic change will require reverse logistics, digital tracking tools such as building passports, and new business models. Despite the large volume of construction and demolition waste, it is rarely traded. Most is landfilled or downcycled domestically, even though secondary materials could address shortages in other regions. This is partly due to the absence of international standards and certification for reused components. Developing traceability tools, technical specifications, and mutual recognition frameworks could help build a more efficient global market for circular construction inputs. Evidence from Norway (Wiebe et al., 2023) suggests that shifting to circular models in construction not only reduces emissions and import dependency but also boosts local employment when reuse and recycling are prioritized.

Circular construction is therefore both an environmental and economic opportunity. Pilot projects across Northern Europe have shown promising potential, including adaptive reuse and materials banks. However, they remain limited in scale. To unlock broader impact, coordinated efforts are needed to align standards, improve trade classifications, and support cross-border circular flows. The construction industry demonstrates that even resource-heavy sectors can benefit from circular trade frameworks, provided technical standards and customs classifications are updated to reflect CE realities.

4 Discussion

The shift toward a circular economy represents not only a technical evolution but also a deep institutional and policy transformation. Although the potential of circularity is increasingly acknowledged, current trade systems have not yet adapted to the specificities of circular flows such as remanufactured goods, secondary raw materials, and reused components. Tuerk and Sporysheva (2022) highlight this institutional lag, particularly within trade frameworks. Our analysis builds on their argument by stressing the need for alignment between trade classifications, customs procedures, and sector-specific regulations to enable effective circular transitions across borders.

The textile and construction sectors illustrate these misalignments particularly well. They are both resource-intensive and deeply embedded in global value chains, and as such, offer highly visible examples of circularity potential obstructed by fragmented regulation. Suarez-Visbal et al. (2024) emphasize the importance of embedding CE into social and labor contexts; our findings extend this by demonstrating how trade-related asymmetries and weak institutional coordination can undermine those efforts. In particular, we show that second-hand textile trade remains controversial due to lack of standardization and its socio-economic implications—an area underdeveloped in most policy analyses. This aligns with Das et al. (2025), who call for more inclusive CE strategies in global supply chains, but we add a trade governance lens that reveals how policy misalignment across countries distorts outcomes.

In the construction sector, Huovila and Westerholm (2022) argue that the lack of building-level circular standards limits progress. We confirm this but go further by showing that trade restrictions on reused materials—caused by safety code discrepancies and outdated customs classifications—represent systemic trade barriers. This complements the work of Wiebe et al. (2023), who focused on environmental and employment impacts of circular construction; our contribution highlights how international trade frameworks must evolve to support such models beyond national contexts.

The role of stakeholders is equally critical. Onukwulu et al. (2025) argue that successful CE implementation depends on effective stakeholder engagement. Our paper expands on this by mapping out how different actors—governments, customs authorities, firms, trade organizations, and civil society—interact with and are constrained by trade rules that lack clarity and consistency. While Loviscek (2025) emphasizes the dominance of

large firms in CE governance, we advocate for a more balanced approach involving a wider range of actors, particularly civil society and trade institutions, whose roles are often overlooked.

Concretely, each stakeholder contributes differently to circular trade outcomes. Governments often lack inter-ministerial coordination, resulting in fragmented policies. Customs authorities struggle with outdated classification systems that mislabel circular goods as waste. Firms face high costs and regulatory uncertainty without strong market incentives. Trade organizations rarely integrate circularity explicitly into agreements, while NGOs and civil society, despite their advocacy role, remain marginal in trade dialogues. Unlike earlier literature, our contribution systematically connects these roles to specific trade instruments—such as product passports, mutual recognition of standards, and CE-aligned procurement—offering practical pathways for policy reform. Without stronger coordination among these actors, circular transitions will remain partial, uneven, and exclusionary.

To achieve scalable circularity, we need international trade frameworks that no longer treat circular goods as regulatory exceptions, but as central components of a sustainable global economy.

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