POLICY BRIEF

Circular Solutions for Redesigning Supply Chains: A Pathway to Sustainable Economic Growth

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Trade and Investment

Abstract

The traditional linear supply chain model which is based on the "take, make, and dispose" strategy, includes the extraction of natural resources, production of goods for consumption, and disposal. This open-loop system causes major environmental problems such as waste generation, resource scarcity, and climate change. To address these environmental issues, the concept of the Circular Economy (CE) has emerged.

This policy brief adopts an integrated approach combining CE principles, that are aligned with the United Nations Sustainable Development Goals (SDGs), (particularly with SDG 12, 13, and 8), and with global supply chain management, thus, serving as a transformative solution. Aligned with G20 agendas, the transition to a circular supply chain can help nations achieve major improvements in efficient energy usage, waste management, and resilience to global challenges. The CE concept emphasises using the principles of the 3Rs (Reduce, Reuse, Recycle), sharing, repair, refurbishment, remanufacturing, and regeneration. It reduces dependence on natural resources by reintroducing materials into the production cycle to create value and promote a closed-loop economy model. While developed nations have achieved significant progress in certain areas of environment sustainability such as resource efficiency, waste reduction, and extended producer responsibility, emerging economies continue to face challenges such as inadequate infrastructure, limited economic support, and a lack of standardised systems.

The CE concept requires business entities to reform their value chain cycles and adopt a holistic approach. This framework will help the businesses choose appropriate green alternatives such as adoption of renewable energy and selection of low-carbon transition plans, thus providing a first step to achieving net zero emissions. The policy brief highlights the need for financial assistance for businesses and knowledge sharing through cross-border collaborations, emphasising the value of cooperation, compliance, resource sharing, and technical innovation in advancing a global paradigm for circular supply chains. This economic transformation from an open-loop system to a closed-loop production system will lead to a robust, sustainable, and equitable global supply chain management system, thus promoting environmental sustainability and inclusive growth.

Keywords: Supply Chain, Circular Economy, SDGs, Economic Growth

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Diagnosis

Climate change is a global challenge to sustainable development, affecting ecosystems, water resources, and human populations. Unsustainable consumption patterns cause environmental challenges such as power shortages, waste generation, and resource scarcity, which cause extreme weather, disrupt food supplies, and compromise social stability.[1] Businesses that adhere to an industrial mindset and use the take-make-use and dispose model are currently experiencing pressure on their resources and profit-earning capacity because this technique exploits unlimited resources without regard for future potential use.[2] To solve the problem of climate change and mitigate environmental issues, businesses are now being encouraged to implement the Circular Economy (CE) concept.

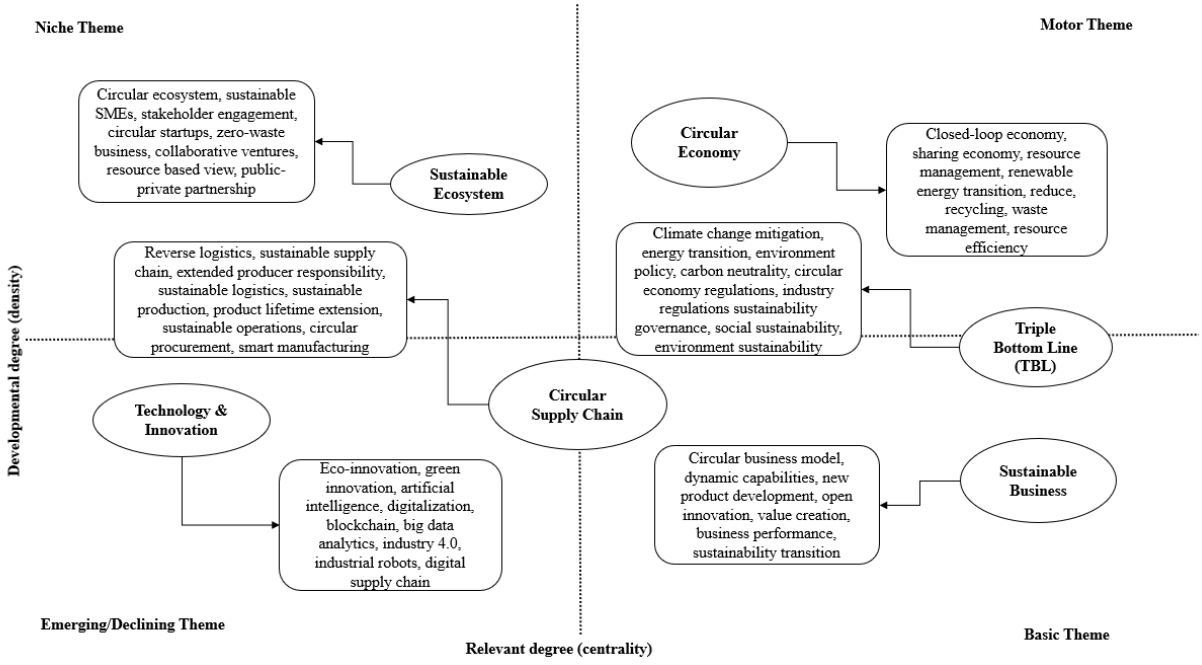
The CE is a cyclical system that recycles waste into new resources, eliminating material loops in industrial ecosystems and promoting ongoing resource consumption.[3] The CE concept replaces an open-loop system based on linear production and consumption methods with a closed-loop circular model.[4] It encompasses industrial ecology, regenerative economy, product life cycle extension, sharing economy, the 3Rs (reduce, reuse, and recycle), and environmental sustainability.[5] Businesses, government organisations, and civil society have collectively expressed interest in this idea because of its ecological

[1] Perera, Hewege, and Mai, "Theorising the Emerging Green Prosumer Culture and Profiling Green Prosumers in the Green Commodities Market."
[2] Geissdoerfer et al., "The Circular Economy – A New Sustainability Paradigm?"; Provasnek, Sentic, and Schmid, "Integrating Eco-Innovations and Stakeholder Engagement for Sustainable Development and a Social License to Operate."
[3] Geissdoerfer et al., "The Circular Economy – A New Sustainability Paradigm?"; Ferasso et al., "Circular Economy Business Models: The State of Research and Avenues Ahead."
[4] Goyal, Chauhan, and Mishra, "Circular Economy Research: A Bibliometric Analysis (2000–2019) and Future Research Insights."
[5] (Goyal, Esposito, and Kapoor 2018; Merli, Preziosi, and Acampora 2018)

benefits and operations.[6] CE plays a key role in global trade by promoting sustainability and resilience within supply chains. Since the G20 members represent the majority of global GDP, they can serve as leaders in global sustainability, with their potential to inspire and influence other nations to adopt a CE approach to achieve the SDGs,[7].

Existing Knowledge in Circular Economy and Global Supply Chain

Figure 1: Thematic Mapping of the existing literature in Circular Economy and Global Supply Chain



Source: Web of Science database

[6] Ghisellini, Cialani, and Ulgiati, "A Review on Circular Economy: The Expected Transition to a Balanced Interplay of Environmental and Economic Systems"; Korhonen, Honkasalo, and Seppälä, "Circular Economy: The Concept and Its Limitations."
[7] Campoli et al., "Advancing Circular Economy: G20 Nations' Path Towards 12th Sustainable Development Goal."

Figure 1 shows a thematic mapping of certain themes extracted from the literature. The depicted conceptual structure has the two most important factors, namely, centrality and density, where centrality represents the degree of association of themes with another, and density measures the magnitude of internalities within the themes.[8] The thematic map depicts six prominent themes namely, circular economy, sustainable business, triple bottom line, circular supply chain, technology & innovation, sustainable ecosystem, based on the growth rate and importance.

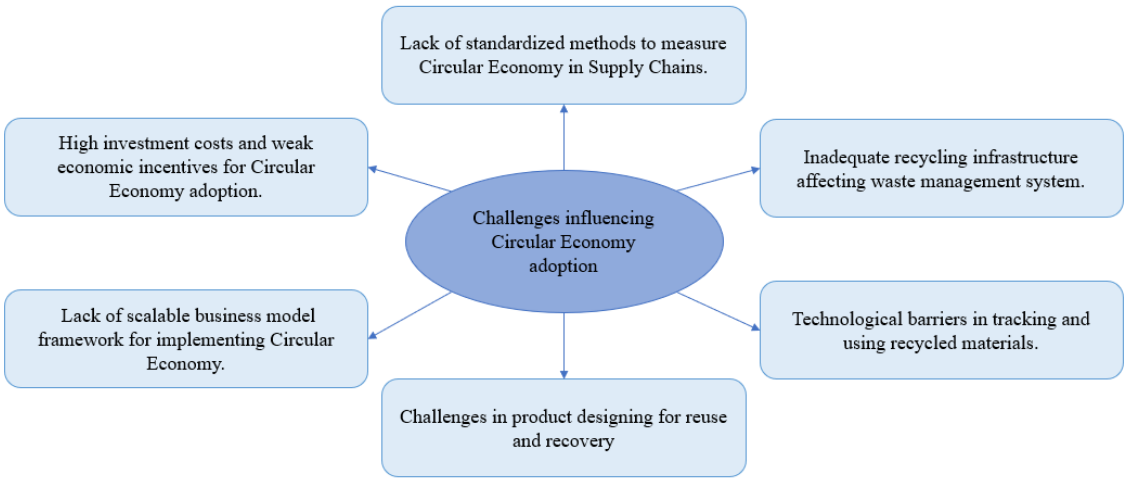
The most dominant theme of the motor quadrant is the circular economy, which fosters resource efficiency and sharing economy principles, which are critical for sustainable development.[9] Basic themes are underdeveloped but important to the study. There are two basic themes shown in the map; sustainable business and triple bottom line, which supports that the transition requires aligning CE principles with the business model, with governments and international bodies advocating for regulations to improve resource efficiency and reduce waste, promoting responsible business practices.[10] The next theme, which falls under the emerging and basic quadrant, is the circular supply chain, which is a key force behind sustainability as circular supply chains are transforming conventional systems into more resource-efficient models.[11] The next emerging theme is technology and innovation, which encourages businesses to embrace new technologies to promote sustainable manufacturing with the support of technological transformations. Sustainable ecosystem is the niche theme which includes circular startups, which are essential for promoting circularity in the ecosystem.[12]

[8] Cobo et al., "25 Years at Knowledge-Based Systems: A Bibliometric Analysis"; Bamel et al., "The Extent and Impact of Intellectual Capital Research: A Two Decade Analysis."
[9] Geissdoerfer et al., "The Circular Economy – A New Sustainability Paradigm?"
[10] Bocken et al., "A Literature and Practice Review to Develop Sustainable Business Model Archetypes"; Geissdoerfer et al., "Drivers and Barriers for Circular Business Model Innovation."
[11] Govindan and Hasanagic, "A Systematic Review on Drivers, Barriers, and Practices towards Circular Economy: A Supply Chain Perspective."
[12] Mukherjee et al., "Socio-Economic Sustainability with Circular Economy — An Alternative Approach."

Challenges influencing circular economy adoption

The concept of CE is widely regarded as a transformative approach for global trade and supply chains, which provide solutions to resource scarcity, waste management, and environmental sustainability. It serves as a pathway to economic resilience, innovation, and sustainable development, particularly within G20 countries. However, a critical review of existing literature reveals that while CE presents significant opportunities, its implementation within global supply chains faces numerous structural, technological, and economic challenges, [13] which are depicted in figure 2.

Figure 2: Challenges influencing Circular Economy Adoption



Source: Authors

[13] Govindan and Hasanagic, "A Systematic Review on Drivers, Barriers, and Practices towards Circular Economy: A Supply Chain Perspective."

Recommendations

The theme of G20, "Solidarity, Equality, and Sustainability" for 2025 offers the ideal platform to promote CE within the global supply chain system. It encourages solidarity by fostering international collaboration and cooperation for circular trade policies, waste reduction, and sustainable supply chain development. Equality is achieved by making resource-efficient technology available to all countries, particularly developing ones. Sustainability, which is the centre of CE, supports carbon neutrality goals, responsible production, and waste reduction, which is essential for a resilient economy.

To address the six global issues highlighted in Figure 2, the policy brief provides the following recommendations:

1. Developing and implementing globally recognised standards for measuring and assessing CE performance across the whole value chain

Globally accepted standards for CE performance in value chains are crucial for industry uniformity and transparency. Similar to climate agreements such as the Paris Agreement which set net-zero emissions and carbon neutrality targets that go beyond the carbon neutrality targets and address emissions across the whole value chain, these standards can take into account the entire lifetime of materials, including resource extraction, production, consumption, and end-of-life management. This holistic approach is crucial because supply chains are complex and include interconnected material flows, waste generation, and recycling processes. By developing CE standards, G20 economies can track material efficiency, waste generation, product life cycles, and resource recovery rates. These metrics will assist in identifying inefficiencies and bottlenecks in the value chains, thus supporting supply chain restructuring. These indicators would help the economies to integrate circularity into their core operational strategies,

by minimising wastage and optimising resources, thus helping them to shift from linear to closed-loop production systems.

2. Strengthening waste management regulatory frameworks to promote recycling efficiency and quality

A well-structured regulatory framework is key to improving the waste management system and ensuring high-quality recycling. As industries operating in G20 countries are transitioning towards CE, inefficiencies may exist due to varying waste management rules, which leads to inappropriate waste disposal. Improving regulatory frameworks can help to eliminate inefficiencies by creating recycling targets, stricter waste disposal laws, and encouraging producer responsibility programmes. The G20 plays an important role in promoting waste management and reducing fragmentation in policies across its member nations. It can develop and implement shared principles among its member countries related to waste classification, sorting requirements, and recycling standards, and supporting trade in recyclable materials. G20 countries can foster innovation in waste management infrastructure and governance by sharing green business practices, creating performance benchmarks, and investing in collaborative pilot projects. Member countries can coordinate their action plans through forums such as G20 Environment and Climate Sustainability Working Group, for improving waste management practices through material recovery targets, and encouraging circular procurement policies in the public sector by Extended Producer Responsibility (EPR) frameworks. This initiative will help to establish and enforce a resource traceability system that will bridge the global recycling quality gap and promote equitable circular development.

3. Fostering the development and adoption of advanced digital solutions to improve material tracking and reuse

The implementation of smart tracking technology is vital for monitoring material flows and optimising reuse in order to successfully implement EPR and achieve

the objectives of CE. Blockchain-based reporting, smart product labels, and track-and-trace systems can enhance material recovery, regulatory compliance, and data accuracy. Mandatory reporting frameworks, which are bolstered by smart product identifiers, such as digital product passports, can further encourage businesses operating in G20 countries, to improve reuse rates, particularly in the management of packaging waste. The G20 can leverage initiatives like circularity-specific indicators, digital material passports, and coherent product tracking systems. The Digital Economy Working Group under the G20 can embed CE objectives into digital governance discussions, particularly around cross-border data standards, ethical AI use, and SME digital inclusion, while encouraging harmonisation of waste tracking system and material recovery standards. This initiative could promote open-source platforms for CE data sharing, co-develop regional hubs for circular innovation, and provide funding for projects integrating digital tools into product design, recycling infrastructure, and lifecycle assessment models, thus helping in building a resilient and scalable supply chain system.

4. Establishing policies that require businesses to design products for durability and repairability

To promote CE, the G20 governments should create laws mandating companies to create durable and repairable products. Eco-design is an approach to product development that incorporates environmental issues, reduces waste, and maximises resource efficiency. Policymakers can set required eco-design standards and enforce these by means of certification programmes, regulatory compliance audits, and costs for non-compliance in order to apply these policies. Standardised eco-labelling systems such as design-to-repair principles, require manufacturers to provide replacement parts and software assistance, thus encouraging businesses to opt for green alternatives. Effective application of product designing policies depends on cooperation among G20 countries since

they account for a major share of global production, consumption, and environmental impact.

5. Facilitate the growth of circular economy-driven business models through regulatory support

The G20 plays a vital role in fostering a circular supply chain system by encouraging enterprises to adopt circular business models by providing incentives, and regulatory support systems. By promoting the adoption of circular business models, the G20 can help to restructure the global supply chain to become more regenerative and efficient. These models aim to extend product life, increase value, and improve material flows within and across supply chains. Regulatory systems should promote cooperation, cascaded resource use, and repair, and remanufacturing within the same supply chain, thereby increasing material value. Targeted restrictions will encourage enterprises to adopt asset-sharing and Platform as a Service (PaaS) models. Policies should promote reverse logistics networks, so producers can remanufacture, reclaim, or refurbish goods, reducing resource extraction and production costs. To operationalise the implementation of CE driven business models, G20 may encourage capacity building programmes, industry alliances, and knowledge-sharing platforms, specifically focusing on emerging G20 nations, through platforms like the G20 Business 20. It can promote international expertise and successful circular business models through workshops, innovation hubs, and projects, focusing on emerging economies. Thus, by partnering with governments, industry, and investors to share the best practices and co-develop environment impact assessment tools, the G20 can reduce risks of resource dependency and environmental degradation, thus promoting economic resilience and sustainable growth.

6. Providing economic incentives to offset the high costs of transitioning to a circular economy

To reduce the high infrastructure, technological, and process innovation costs and, improve long-term profitability of the businesses, policymakers should create suitable financial support systems and economic incentives, hence accelerating CE adoption. While the development and implementation of financial support systems and economic incentives such as tax credits, subsidies, and grants, are carried out at the national level, the G20 plays a crucial role of coordinator and enabler of these policy initiatives. As a global forum of the largest economies, the G20 can assist in guiding policy framework across its member countries by promoting best practices and integrating CE incentives for industrial strategies. The G20 global platform can provide coordinated international collaboration to promote CE, by prioritising CE projects and helping emerging economies to access affordable capital. Circular supply chains can be encouraged by environmental taxes and tariffs covering all environmental externalities. Providing tax incentives, low-interest loans, and subsidies to corporations which follow CE principles is crucial for adoption. Public-private partnerships can co-finance CE projects, decreasing financial risks while encouraging innovation. By integrating CE incentives within broader G20 frameworks like the G20 Sustainable Finance Roadmap group, fosters alignment between national fiscal policies and global sustainability goals, thus encouraging collaboration and promoting scalable circular value chain solutions globally.

Conclusion

Policymakers should encourage a systematic change toward sustainable and resilient supply chains by using standardised indicators, enhancing waste management policies, deploying digital tracking technology, supporting eco-designing, encouraging circular business models, and providing financial incentives. The transformation to a circular supply chain is essential to achieve the targets of the United Nations SDGs 2030 and the Paris Agreement, thus ensuring environmental sustainability and inclusive economic growth.

T20 South Africa Convenors

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