

Task Force 02

SUSTAINABLE CLIMATE ACTION AND INCLUSIVE JUST ENERGY TRANSITIONS

Accelerating the Transition to a Functional Circular Economy by Mainstreaming Remanufacturing

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Abstract

Radically transforming global value chains is critical to succeeding in our collective ambition of co-creating a sustainable world. This ambition is exemplified in the G20’s vision of Designing a Circular Economy World through the establishment of the Resource Efficiency and Circular Economy Industry Coalition (RECEIC).¹ The RECEIC highlights six Rs of circularity – redesign, reduce, reuse, **remanufacture**, repair, and recycle.

Remanufacturing is an industrial process that restores end-of-life (EOL) goods to original working condition or better.² It involves the collection, disassembly, cleaning, inspection, rebuilding/replacing, reassembly, and testing of goods such as automotive and aerospace components, medical devices and electronics, before they re-enter the market. Remanufactured goods are indistinguishable from new goods in terms of quality, performance, appearance, functionality and warranty,³ and in some cases can outperform

¹ “Resource Efficiency and Circular Economy Industry Coalition: Presidency Document”, India’s G20 Presidency, last modified July 2023,

https://www.g20.in/content/dam/gtwenty/gtwenty_new/document/G20_ECSWG-Resource_Efficiency_and%20Circular_Economy_Industry_Coalition.pdf.

² “Remanufactured Goods: An Overview of the U.S. and Global Industries, Markets, and Trade”, U.S. International Trade Commission, accessed March 31, 2024, https://www.usitc.gov/publications/industry_econ_analysis_332/2012/remanufactured_goods_overview_us_and_global.htm.

³ “Making India a Global Leader in Remanufacturing”, Recreate India Research Foundation, last modified October 2023,

<https://recreateindia.org/publications/makingindiaagloballeader/>.

new goods. It is performed across borders and sectors by some of the world's most respected companies. Yet, its share in global production is estimated to be 2 to 3 percent.

The United Nations (UN) International Resource Panel (IRP) notes that compared to linear production, remanufacturing can⁴:

- Reduce new material requirements by 80 to 98 percent
- Lead to a cut of about 90 percent in production waste
- Avoid 79 to 99 percent of embodied material, energy and emissions
- Avoid 57 to 87 percent of process energy and emissions
- Create more jobs, cost less and open new markets

To accelerate the transition to a strong and functional circular economy, this policy brief recommends G20 members take steps to:

1. Agree on common taxonomy for remanufacturing to facilitate cooperation for a) accelerated adoption of remanufacturing practices and b) international trade
2. Mainstream remanufacturing so that it becomes a normal aspect of any product's lifecycle
3. Close the financing gap by further aligning the realms of finance and circular economy

⁴ “Re-defining Value – The Manufacturing Revolution”, United Nations Environment Programme (UNEP) International Resource Panel, last modified February 09, 2022, <https://www.resourcepanel.org/reports/re-defining-value-manufacturing-revolution>.

Diagnosis of the Issue

According to The Circularity Gap Report 2024⁵, the volume of discussions, debates and articles on the concept of the circular economy has tripled over the past five years. However, the share of secondary materials consumed by the global economy has decreased from 9.1 percent in 2018 to 7.2 percent in 2023 – a 21 percent drop over the course of five years. And over the same period, global consumption continued to accelerate with the world consuming 500 gigatonnes of materials, which equals 28 percent of all the materials humanity has consumed in a little over 100 years (since 1900).

As highlighted by Chatham House's⁶ 9R Framework (which aligns with the RECEIC's six Rs of circularity), the various approaches to actualizing the circular economy include Reduce, Refuse, Redesign, Reuse, Repair, Refurbish, **Remanufacture**, Repurpose and Recycle. (Figure 1). These nine approaches fit into the two broad categories of slowing resource flows and narrowing resource flows. It is in slowing resource flows significantly where remanufacturing shines. Recycling has its place in the circular economy; however, remanufacturing has the ability to deliver significantly more powerful environmental, social, and economic benefits. So why is remanufacturing's share in global production so low?

⁵“The Circularity Gap Report 2024”, Circle Economy Foundation, last modified March 25, 2024, <https://www.circularity-gap.world/2024>.

⁶“Financing an inclusive circular economy”, Chatham House, last modified July 28, 2021, <https://www.chathamhouse.org/2021/07/financing-inclusive-circular-economy>.

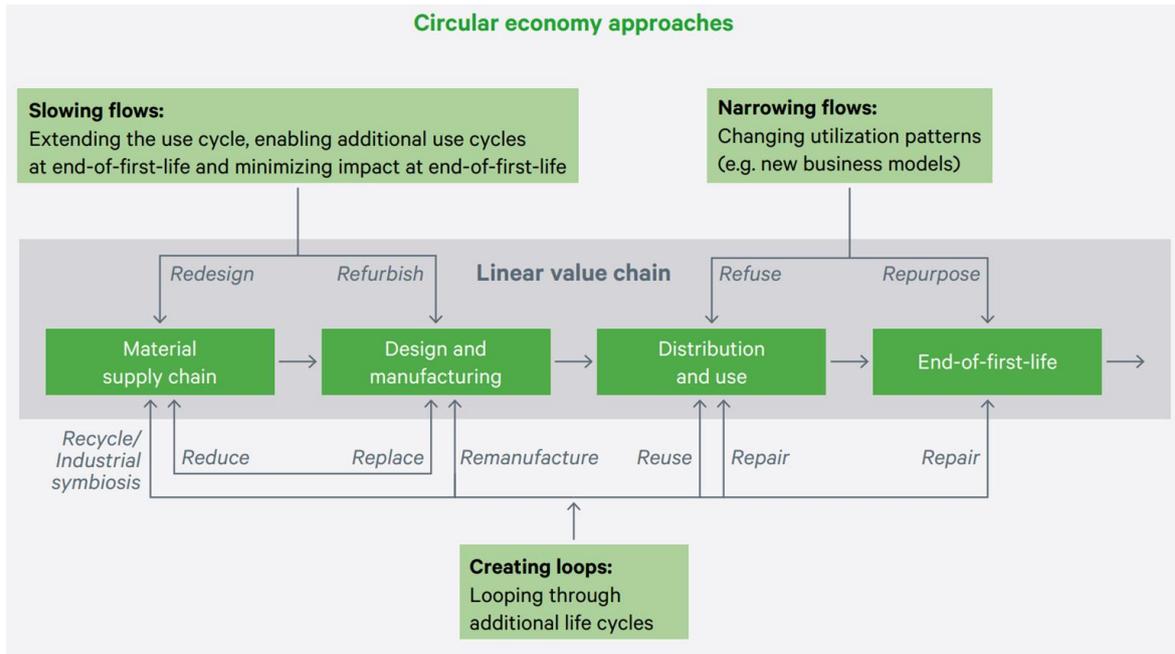


FIGURE 1. Circular Economy Approaches

1. A fragmented narrative and taxonomy

One of the primary obstacles limiting the natural growth of remanufacturing is the perception and acceptance of remanufactured products in the marketplace. This stems from the fact that the term ‘remanufacturing’ is not universally applied. Industry sectors around the world use different terms to identify the remanufacturing process. For instance, in the automotive and commercial vehicle sectors, the term is remanufacturing itself; in aviation and aerospace, the label is *maintenance, repair and overhaul (MRO)*; and for consumer goods and electronics, the term is *refurbishing*. These nicknames have gained acceptance because their application aligns with the positive definition of the remanufacturing process.

However, further work is needed to harmonize terms. For example, although the medical devices industry uses the term *refurbishing* in lieu of remanufacturing, it has characterized the term remanufacturing to define a modification process that

“significantly changes the finished device’s performance or safety specifications, or intended use.”⁷ This unfortunately casts remanufacturing in an inaccurate and less-than-favourable light.

2. The grip of linear design on manufacturing

Over 80 percent of the environmental impacts from products are determined during the design phase⁸, 60 to 80 percent of a product’s total cost is set at design⁹, 93 percent of production materials are not within the final product, while 80 percent of products are discarded after a single use. In spite of this, consideration of the profound impacts of design throughout the entire life cycle of products is underappreciated in product development due to a lack of awareness, expertise, cost pressures, and appropriate tools to assist design decisions. Designers typically lack Design for Remanufacturing (DfRem)

⁷ “Remanufacturing and Servicing Medical Devices”, U.S. Food and Drug Administration, last modified August 18, 2023, <https://www.fda.gov/medical-devices/quality-and-compliance-medical-devices/remanufacturing-and-servicing-medical-devices>.

⁸ “Waste Management”, Department for Environment Food and Rural Affairs, Government of the United Kingdom, accessed March 31, 2024, <https://assets.publishing.service.gov.uk/media/5a7c8d85e5274a7b7e32135e/env-impact-waste.pdf>.

⁹ “Concurrent Engineering: A Key Competitive Dimension”, Project Management Institute, accessed March 31, 2024, <https://www.pmi.org/learning/library/concurrent-engineering-key-competitive-dimension-9016>.

expertise because they are uncommon in higher education curricula and skill-development programs.

3. The need to expand financing for remanufacturing

According to the United Nations Industrial Development Organization's (UNIDO) Industrial Analytics Platform (IAP), despite strong evidence showing that the circular economy offers superior financial risk-adjusted returns and improved industrial resilience, investment in the circular economy faces a severe finance gap¹⁰. In a recent report, Chatham House^{vi} found that, worldwide, public sector spending on the circular economy totalled between \$500 billion and \$600 billion in 2020, compared with overall government spending of about \$13 trillion. Meanwhile, the value of annual circular economy spending by the corporate sector is estimated at around \$850 billion, compared with \$35 trillion in linear spending. This puts the circular economy's share of total global investment at only about 3 percent per year.

In addition, more than 20 Sustainable Finance Taxonomies – which are shared classification systems for defining environmentally sustainable investments – have now been launched, or are being developed, worldwide. These taxonomies generally target a set of environmental objectives such as climate change mitigation, pollution reduction, or circular economy. Although it is being incorporated into some taxonomies under

¹⁰“Unlocking the circular economy through green finance”, UNIDO Industrial Analytics Platform, last modified September 2023, <https://iap.unido.org/articles/unlocking-circular-economy-through-green-finance>.

development, the circular economy – and by extension, remanufacturing – is largely missing from most of the existing taxonomies.

Recommendations

Before the recommendations are presented, two important points must be considered:

1. Remanufacturing offers a proven and practical pathway towards green growth and circularity. Studies have shown that remanufacturing promotes demand for labour.¹¹

2. A one-size-fits-all solution is not the answer, and solution-development will need to be regionally nuanced and thoughtfully crafted, keeping in mind cultural, economic, and industrial differences among the G20 members as well as the principle of **Common But Differentiated Responsibilities (CBDR)**.

It is in this spirit that the recommendations below have been developed.

1. Establish an ‘International Remanufacturing Committee’ within the RECEIC

This recommendation on establishing an **International Remanufacturing Committee (IRC)** within the RECEIC addresses the first two issues highlighted in the

¹¹ Ferrer, G., Ayres, R. U., “The impact of remanufacturing in the economy”, *Ecological Economics*, 32: 413–429 (2000), [https://doi.org/10.1016/S0921-8009\(99\)00110-X](https://doi.org/10.1016/S0921-8009(99)00110-X).

preceding section, i.e., 1. A Fragmented Narrative and Taxonomy and 2. The Grip of Linear Design on Manufacturing.

This Committee can convene the relevant stakeholders, including international industry representatives, researchers, policy makers, and subject-matter experts to deliberate and arrive at robust recommendations that can shape the future of industrial development by mainstreaming remanufacturing, eliminating confusion around taxonomy and definitions, and providing clear guidance on policy design, especially for those nations that are in the early stages of exploring circular economy pathways in support of long-term sustainable development. The issues that this Committee can address to accelerate the transition to a functional and strong circular economy by mainstreaming remanufacturing are listed here in no particular order (not an exhaustive list):

1.1 Harmonization on taxonomy

The harmonization of language and terminology related to remanufacturing can:

- Lead to the acceleration – especially in developing nations – in the adoption of remanufacturing practices, as national policies/roadmaps and legislation are developed.
- Facilitate greater acceptance of remanufactured goods in the marketplace.
- Enable greater ease in the international trade of remanufactured products, as well as the movement of EOL products destined for remanufacture. One of the key challenges that can be overcome, in the vein of international trade and the related language used in policies and legislation, is the classification of EOL products as waste rather than raw materials for remanufacture.

1.2 Clarity in international trade

In its recent study report titled “Transition to a circular economy and implications for Customs administrations”¹² the World Customs Organization (WCO) highlights some of the challenges faced by Customs in the circular economy: “Possible ambiguities surrounding the application of the circular economy concept and the interpretation of provisions in environmental and waste management laws could increase uncertainties around the importance, value and diversity of traded goods involved in circular transformations and generate greater uncertainty for Customs on how to deliver effective controls, monitoring, enforcement, and facilitation. For example, **the lack of a common definition of waste and non-waste could be challenging**, with each country having the right to have a different interpretation about the materials and products needed to serve as inputs for a circular economy.”

Recently, specific provisions regarding remanufacturing have been found in Regional Trade Agreements (RTA) among developed countries. These provisions request that trading partners ensure equal treatment between remanufactured goods and new products, and prohibit any prohibitions or restrictions on remanufactured goods. Examples include:

¹² “Transition to a circular economy and implications for Customs administrations”, World Customs Organization, last modified June 2024, <https://www.wcoomd.org/-/media/wco/public/global/pdf/topics/research/report/circular-economy-report-en.pdf>.

- a) The United States-Mexico-Canada Agreement (USMCA) entered into force in July 2020.
- b) The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) entered into force in December 2018 among 11 Pacific members.
- c) The EU and Japan's Economic Partnership Agreement entered into force in February 2019.
- d) EU-Vietnam Free Trade Agreement signed in June 2019.

However, more needs to be done in the vein of ensuring clarity in the language surrounding international trade and related agreements to facilitate greater adoption of remanufacturing, especially in developing nations.

1.3 Formalizing educational curriculum

Design for Remanufacturing (DfRem) must be integrated in all educational curriculum (from grade school to university and executive education). DfRem enables remanufacturing by facilitating the different remanufacturing steps, (disassembly, cleaning, inspection, testing, component rebuild and reassembly), with appropriate design considerations¹³ such that an end-of-life product can successfully pass through the steps

¹³ Lindkvist Haziri, L., Sundin, E., “Supporting design for remanufacturing - A framework for implementing information feedback from remanufacturing to product design”, *Journal of Remanufacturing*, 10:57–76 (2020), <https://doi.org/10.1007/s13243-019-00074-7>.

of the remanufacturing process to provide one or more full-use lifecycles. Effective DfRem should ensure products' upgradability to new functionality and specifications to extend their useful life prior to obsolescence, while keeping cost considerations in mind.

National training schemes, skill development programmes, and structured apprenticeships must be developed to ensure that there is, at minimum, a fundamental understanding of remanufacturing and at advanced levels, the transfer of applied knowledge, skills, and expertise gained from years of practical experience.

Mainstreaming remanufacturing through the universal adoption of standardized DfRem processes requires a multi-pronged approach that addresses the key barriers and challenges, including the development of robust, certified industry-useable DfRem, buoyed by campaigns to raise awareness and understanding of remanufacturing and its benefits.

1.4 Mass-media awareness campaigns

The original recycling symbol was designed in 1970 as a submission to the International Design Conference which was part of a nationwide contest sponsored by the Container Corporation of America. The contest was a result of continuing growth of consumer awareness and environmentalism and a response to the first Earth Day.¹⁴ It is commonplace today to expect to find recycling bins in homes or on the street and the 3Rs and its logo are universally recognized.

¹⁴ “The Origin of the Recycling Symbol”, Middle Tennessee State University, last modified August 24, 2023, <https://w1.mtsu.edu/cee/3Rs.php>.

By leveraging mass-media channels, social media networks, and stakeholders across the spectrum (from industry and government to research and academia), the profile of remanufacturing must be elevated so that present and future generations associate pride and social status to remanufactured products and systems, and expect and demand remanufacturing as a part of everyday life.

1.5 Product and process certification

Certifications will help elevate remanufacturing and offer a level of assurance to buyers and users of remanufactured goods. For example, one certification available in the marketplace today is the Manufactured Again™ certification¹⁵, which holds remanufacturers to the same international quality standards as new manufacturers. Based on ISO 9001 – the world’s leading quality management system standard – this certification requires third party verification. Programs like this are essential for identifying authentic remanufacturers and reducing unfair or deceptive practices by others who falsely claim to remanufacture but deliver subpar results.

1.6 Technology development

Currently, remanufacturing has low technology and innovation levels in comparison to conventional manufacturing. Many remanufacturers still use second industrial revolution era techniques and thus remanufacturing is three to five times more labour

¹⁵ “Manufactured Again Certification”, MEMA Aftermarket Suppliers, accessed March 31, 2024, <https://www.manufacturedagain.com/certification/>.

intensive when compared to the manufacture of the same product¹⁶. Conventional manufacturing is now in a period of rapid digitalisation, which will further increase its advantages (e.g., speed, accuracy, and cost performance of mass production). Digitalisation technologies can greatly reduce costs and improve the flexibility and sustainability of manufacturing systems¹⁷. It is critical that remanufacturing follows suit and reduces its current technology gap in order to future-proof the industry and remain relevant.

2. Establish a ‘Commission to Expand Sustainable and Circular Finance for Remanufacturing’ (CESCFR) within the RECEIC

In its report “Financing an inclusive circular economy: De-risking investments for circular business models and the SDGs”, Chatham House highlights the sustainable finance instruments that support the circular economy, shown below in Figure 2.

¹⁶ Lundmark, P., Sundin, E., & Björkman, M., “Industrial Challenges within the Remanufacturing System”, *Proceedings of the 3rd Swedish Production Symposium*, 132 -138 (2009), <https://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-63005>.

¹⁷ Melissa Demartini, Steve Evans, Flavio Tonelli, “Digitalization Technologies for Industrial Sustainability”, *Procedia Manufacturing*, Volume 33, Pages 264-271 (2019), <https://doi.org/10.1016/j.promfg.2019.04.032>.

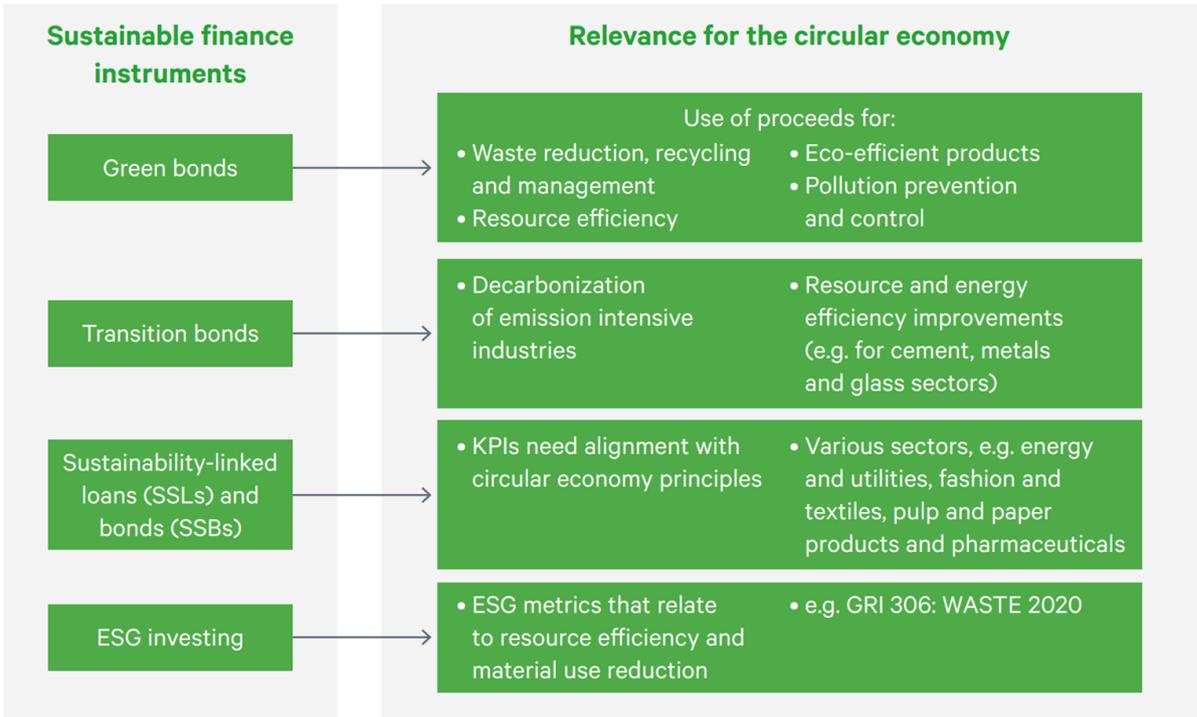


FIGURE 2. Sustainable finance instruments that support circularity

The authors of this policy brief recommend the RECEIC establish a ‘Commission to Expand Sustainable and Circular Finance for Remanufacturing’, to specifically address the following:

2.1 Bring harmonization on sustainable and circular finance taxonomy

Out of the 20 taxonomies developed or under development worldwide, the EU’s Sustainable Finance Taxonomy is arguably the most ambitious and comprehensive in integrating the circular economy. The EU taxonomy uses specific criteria to classify economic activities that may substantially contribute, or cause significant harm, to the circular economy transition. It therefore provides lessons on the opportunities and unique challenges in leveraging taxonomies to accelerate the circular economy transition. The EU’s ‘Regulation (EU) 2020/852 on establishing a framework to facilitate sustainable

investment’¹⁸ aims to inform investors on whether an economic activity is environmentally sustainable by setting common EU-wide criteria. While the learnings from the EU experience must be given due consideration, there is a critical need to include the perspectives and economic imperatives of Emerging Market and Developing Economies (EMDEs), their hundreds of millions of aspirational citizens, and the social norms and ambitions of “owning new”.

2.2 Turn regulatory pressure into commercial opportunity

In the short term, policymakers and regulators need to ‘nudge’ the finance sector towards circularity through clear policy directions. Policy instruments such as circular economy roadmaps, EPR initiatives, and tax reforms provide the necessary policy signals to the finance sector. Long-term institutional investors will then be able to build effective coalitions and investment vehicles to accelerate the transition to a circular economy.

¹⁸“Assessing environmentally sustainable investments”, EUR-Lex: Access to European Union Law, accessed March 31, 2024, <https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=CELEX:32020R0852>.

2.3 Integrally assess linear and circular risks¹⁹

Linear risk – the risk incurred by continuing to do business under the unsustainable assumption of infinite resources – must be explicitly included in financing decisions. Circular risk needs to be assessed more realistically by focusing risk models on the future and seeking assurances in future cash flows, long-term stability, chain cooperation, and contracts.

2.4 Expand and optimize financing instruments

Financing instruments need to be expanded and optimized to make circular financing the new ‘business as usual.’ This means developing appropriate financing with more risk capital for early-stage circular companies. Blended finance, government funding, and financial innovation also play an important role in accelerating the timeframe within which this shift can happen.

¹⁹“The Dutch financial sector launches new roadmap to drive the circular economy”, Circle Economy Foundation, last modified March 28, 2024, <https://www.circle-economy.com/news/the-dutch-financial-sector-launches-new-roadmap-to-drive-the-circular-economy>

Scenario of Outcomes

The key recommendations outlined above will require:

- a) Deep stakeholder engagement and coordination
- b) Strategic roadmap development
- c) Targeted funding

Without the necessary upfront allocation of human and financial capital, achieving remanufacturing and realizing its benefits on a wide scale will be challenging.

Remanufacturing is about existential security, not just about making manufacturing sustainable. It is a way to support the development of developing nations without repeating the mistakes of the linear thinking of the past, while concurrently bolstering the momentum achieved in developed nations. The business case is sound and the benefits for society cannot be overstated. Just in the way an orchestra plays from the same sheet of music, and the players listen to each other to create a symphony that moves the human heart, so we too, must act.

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