WORKING PAPER

CIRCULAR ECONOMY, POLLUTION AND CHEMICALS

GACERE
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This document is a concise paper offering relevant facts and figures, and arguments outlining key benefits of the circular economy to address planetary crises or a sustainable development challenge. It is a knowledge product, part of the toolbox, which members of the Global Alliance on Circular Economy and Resource Efficiency (GACERE) have developed, to support their advocacy at political level and multilateral fora for transitioning towards a circular economy. It is not a negotiated document and as such it does not necessarily represent the views of all GACERE members. Furthermore, it does not, nor is it intended to, create any binding, legal or financial obligations under international or domestic law.

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1 Introduction

This section outlines why this document is timely and needed in the context of ongoing research on circular economy and pollution and defines the scope of 'pollution' for this paper.

Pollution knows no borders and it impacts people, economies, and ecosystems. As the planet faces a triple planetary crisis of nature and biodiversity loss, climate change, and pollution, any approach to reducing pollution cannot be isolated, but rather the result of holistic and collaborative efforts, and founded on circular economy approaches. Pollution can have a particularly disproportionate and negative effect on poor, disadvantaged, marginalized, and vulnerable people such as children and the elderly, due to their higher exposure and reduced resilience to social, environmental and economic risks.[1] Hazardous chemical and pollution exposure impacts all humans, including on reproductive health of both male[2] and female workers.[3] However, female workers are more likely to work in high-exposure sectors such as health, textile production, and cleaning, and are more likely to work in lower-paid jobs with higher exposure rates.[4]

Pollution is understood to be the presence or introduction of harmful materials or substances into the environment, including, air, water, soil and organisms.

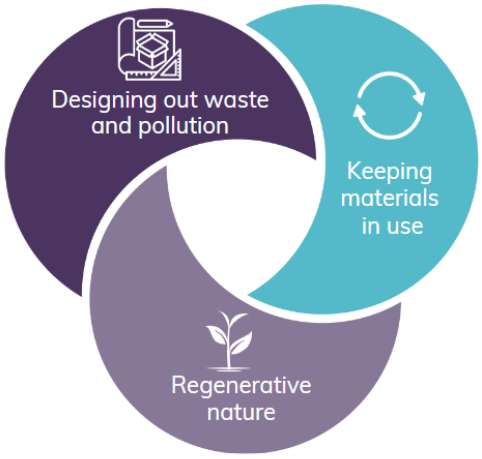
Pollution is therefore complex and occurs across the lifecycle of products and materials. This paper will explore air, water, and soil pollution as well as chemicals management as a cross-cutting issue. While pollution encompasses plastics, waste and GHG emissions, these topics are covered by other GACERE working papers.

In the current linear economic model, pollution is generally accepted as an unavoidable by-product of economic activity that requires regulation. The extraction of natural resources is a significant source of pollution globally, as it is responsible for up to 20% of health impacts from air pollution and up to 80% of biodiversity loss.[5] However, given that up to 80% of the environmental impacts of a product are determined at the design stage,[6] **pollution can more effectively be viewed as a systems, process or product design flaw.** Applying circular economy principles can prevent and eliminate pollution from production and consumption patterns.

80%

of the environment impacts of a product are determined at the design stage

These principles include:



a) designing out waste and pollution (including through product design that uses materials that are able to be recycled, phases out hazardous chemicals that prevent recycling, as well as reduces material intensity and virgin material use while increasing resource efficiency);

b) keeping materials in use (reducing the need for virgin material extraction (which is a high polluting process)), and

c) regenerating nature (aiming to reverse negative impacts on the environment through nature-positive economic activity). Innovation is essential in designing out pollution upstream; nevertheless, most current policy efforts focus on providing downstream regulation.[7]

The **nexus between circular economy and pollution** was clearly established at UNEA-4 in 2019 as Member States welcomed the implementation plan '[Towards a Pollution Free Planet]' where 'building circularity into production processes and supply chains and key economic sectors' was highlighted as a key action required to achieve systemic long-term change against pollution.[8] Since then, research and innovation has progressed. This GACERE working paper is timely to promote the integration of circular economy as a solution to pollution and hazardous chemicals and ensure that ongoing policy priorities are informed by recommendations based on the most recent body of science.

2 Evidence of a polluted planet

This section summarises the current impacts of pollution on health, ecosystems, and economy

- **Air pollution** has been described as 'the world's largest single environmental health risk'[9] – it causes over 6.5 million deaths each year globally,[10] reduces crop yields by up to 15%,[11] and contributes to climate change, impairing photosynthesis, and reducing plant biomass.[12]

- Pollution-related economic losses have been estimated at US $4.6 trillion annually,[13] with air pollution alone accounting for an estimated $2.9 trillion economic cost (3.3% of the world's GDP). [14]

- Untreated industrial and agriculture wastewater flow is an important source of **water pollution**, particularly in lower-income countries with up to 90% of untreated wastewater flow into rivers, lakes, and coastal zones.[15]

- Of the rivers in Latin America, Africa and Asia, it is estimated that severe pathogenic pollution affects around one third of rivers, severe organic pollution affects one seventh of rivers, and severe salinity pollution affects one tenth of rivers.[16]

- The World Health Organization has declared antimicrobial resistance to be one of the top ten global public health threats and the environment. [17] It stems from increased use and misuse of antimicrobial substances (such as antibiotics, antifungals and antiparasitic medicines) polluting soil and water.

- Chemical use from manufacturing is a significant **soil pollution** source and is projected to increase by 85% from 2000 to 2030.[18]

- Pollution to air, soil, and water is responsible for approximately one in six deaths worldwide (9 million deaths per year),[19] and 58% of diarrheal disease cases are due to lack of access to clean water,[20] typically caused by freshwater pollution.

- Disability from chronic diseases resulting from pollution exposure were estimated to cost the global economy US $200 billion in 2018.[21]

- A circular economy offers a US $4.5 trillion economic opportunity[22] while creating a net increase of 6 million jobs by 2030[23] and lowering barriers to entry for marginalised groups (including female workers) by reducing the need to purchase resources, such as fertiliser in agriculture.[24]

3 Circular policy response towards a pollution-free planet

This section outlines existing circular policy instruments on pollution & chemicals, and opportunities to integrate circular economy more systematically into national and regional policies, and multilateral agreements. This section outlines the benefits of circular economy in minimizing and preventing chemical, water, soil and air pollution and provides examples of sectoral applications.

Circular solutions to address pollution for the textile sector alone could generate US $700 billion in economic value by 2030,[25] and are a more effective approach than pollution treatment measures as they aim to minimize harmful environmental impacts of products and materials on a full life cycle basis, and prioritize upstream interventions such as rethinking design practices and consumer needs. This results in more effective outcomes on pollution impacts, cost effectiveness, and performance efficiency. For each category of pollution, this paper gives examples in high-impact sectors where circular solutions can be particularly impactful in minimizing pollution.

Existing policy landscape

The Kunming-Montreal Global Biodiversity Framework adopted at the Fifteenth meeting of the Conference of the Parties to the Convention on Biological Diversity in December 2022 reflects circular economy as a means to achieve targets on reducing pollution from all sources and reforming incentives which are harmful for biodiversity, including on reducing pollution risks and negative impacts of pollution from excess nutrient loss, pesticides, and hazardous chemicals by 2030.[26]

The intersection between pollution and circular economy is a transboundary issue which requires global and regional collaboration. For instance, the Africa Green Stimulus Programme which was adopted by the African Union outlines that scaling up circular economy practices in Africa is a priority for improving air quality through pollution reduction.[27]

A number of countries and regions have already started integrating circularity principles into their pollution policies:

- France's 2020 Anti-Waste and Circular Economy Law applies to all products sold in France and includes requirements such as disclosing how 'eco-designed' a product is (including whether it was designed to reduce or eliminate pollution during the production, consumption, or disposal phases) to consumers.[28]

- Chile's Roadmap for a Circular Chile by 2040[29] is a comprehensive plan for transitioning towards a circular economy. It includes a focus on improper waste treatment which is a significant driver of air pollution and water pollution, particularly for surrounding communities. The Roadmap builds on circular innovation (to enable the private sector to adopt circular solutions that eliminate pollution), circular culture (including consumer campaigns on

pollution impacts and behaviour change), circular regulation (including incentives for eliminating pollution through design), and circular territories (including local infrastructure to support pollution reduction through regional authorities).

- Government-led initiatives can foster market-led innovation to reduce pollution, as demonstrated by the Canadian government's Innovative Solutions Canada initiative.[30] It provides financial and technical support to SMEs to build and test prototypes, as well as conduct research and development based on public policy challenges identified by government departments (such as plastic waste). Public procurement is also leveraged in this initiative to support successful innovations.

- The European Commission's ambitions for circular economy are mainstreamed, through the Action Plan 'Towards a Zero Pollution for Air, Water, and Soil'[31] where by 2050, air, water, and soil pollution is either prevented at the source (including natural resource extraction, material choice, and product design) when possible and, any pollution is minimized and remediated through production and recycling innovation. This plan was adopted in 2021, with a platform providing transparency on progress of both the European Commission and Member States in implementing the plan's vision. It builds on the 2020 EU Chemicals Strategy for Sustainability[32] towards a toxic-free environment. Together, these two strategies are a key commitment of the European Green Deal[33] which adopts circular economy as one of its main building blocks for implementation.

Cross-cutting circular economy policy levers

Many circular economy solutions apply across all pollution areas, as they are often about stimulating innovation, and use resources that can continue in a circular loop, thus minimizing pollution. Research identified a set of overarching enablers that are common to many, if not all key sectors in scaling circular solutions. They include:

- **Design products for circularity,** including by phasing out chemicals of concern, through policy and market incentives such as funding data collection in to support of circular design decision-making, encouraging circular design through higher environmental standards for production and products, as well as investments in research and development to bridge innovation gaps.[34]

- **Improve reusability and recyclability of products** through product design, product lifetime extension requirements, circular business models, as well as incentives for businesses to reuse and recycle products (such as streamlined or flexible administrative requirements), funding research and development, supporting pilot projects).[35]

- **Encourage more pollution prevention through upstream interventions,** similar to the approach in the EU's Zero Pollution Action Plan,and provide financing and scale support for innovations that design out pollution.[36]

- **Strengthen consumer information tools and policies** in line with the UNEP Guidelines for Providing Product Sustainability Information to encourage more sustainable consumption patterns, [37] including through refusing unnecessary products, and re-using products more systematically.

- Encourage consumer-facing communicators (such as in-house communications departments or PR agencies) to adopt evidence-based and transparent communication to champion positive and accessible circular solutions which **shift away from overconsumption**. This includes guidance on sustainable communication or policies against greenwashing.[38]

- **Remove or reevaluate subsidies for polluting technologies** (e.g., price incentives and fiscal subsidies for harmful pesticides in agriculture).[39]

- **Remove tariffs on goods required to develop a circular economy infrastructure**, such as for machinery which substitute a pollutant, or materials required for eco-design.[40]

- **Increase transparency and traceability along the value chains**[41] (e.g., for chemicals in products, pollution impacts of production, but also on women, vulnerable workers, and other trade-offs that may result from circular policies in addressing pollution[42]), including through improving data collection and accessibility for both businesses and policy makers.[43]

- **Collaborate with social protection bodies** to provide incentive and schemes to improve protections for both formal and informal workers, particularly recyclers.[44]

Chemicals pollution

Chemicals of concern not only pose harm to human and ecosystem health but are a significant barrier to products and resources being recovered, reused, or recycled due to hazardous or otherwise problematic chemicals being present, or unknown**. It is estimated that more than 95% of all manufactured goods and articles rely on chemical technologies, and that chemicals can be released at every step in the life cycle of a product**.[45] The composition and the extent of the impacts of many chemicals (including their impacts on environmental or human health) are not publicly known because they are claimed as confidential or ambiguously described.[46] Electronics in particular contain a significant number of hazardous substances that harm human health and pollute the environment during the stages of material extraction, manufacturing, recycling and disposal.[47] In addition, the informal workforce is often engaged in electronics recycling in many countries; government support in improving recycling infrastructure are therefore particularly key for the electronics sector as well as for battery-powered products.[48]

The Strategic Approach to International Chemicals Management (SAICM) has reflected these impacts by identifying hazardous chemicals in electronics as one of six emerging policy issues where greater coordination, knowledge, and urgent action is needed.[49] In this context, the collection and sharing of data on chemicals in products, studies on the risks of chemical mixtures, facilitation of market acceptance of alternative methods or substitutes, and improved transparency on chemicals in products are crucial.

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Circular design can be leveraged to better track and manage chemicals in products as it implies a full life-cycle approach when designing a product or a service which triggers a better understanding of where and when hazardous chemicals can have harmful impacts, and how to design them out. The UNEA resolution 5/7 on Sound Management of Chemicals and Waste encourages the use of the UNEP Framework Manual on Green and Sustainable Chemistry which outlines 10 objectives and guiding considerations that form current best practices for sound management of chemicals, including encouraging elimination of toxic compounds in products and using chemistry innovations to enable non-toxic reuse and recycling circular material flows.

Member States have acknowledged the leveraging role of circularity in addressing pollution and chemicals of concern in several resolutions of the United Nations Environment Assembly,[50] including the importance of minimizing and preventing 'when feasible, the use of hazardous substances in material cycles and managing chemicals in products throughout their life cycle, from design to waste, in order to adapt production and consumption models to achieve sustainable consumption and production, including but not limited to the circular economy and other sustainable economic models.'[51]

The fifth session of the **International Conference for Chemicals Management (ICCM 5)** in Bonn, Germany, 25- 29 September 2023, concluded with the adoption of a **'Global Framework on Chemicals'** which aims at preventing or, where prevention is not feasible, minimizing harm from chemicals and waste to protect the environment and human health, including that of vulnerable groups and workers. The Framework includes 28 targets, addressing the entire chemical lifecycle. Target D2 states that, by 2035, governments implement policies that encourage production using safer alternatives and sustainable approaches throughout the life cycle, including best available techniques, green procurement and circular economy approaches. The accompanying Bonn Declaration also includes a reference to the active promotion and support the transition to circular economies, including through the development of safe chemical and non-chemical alternatives and substitutes that protect health and the environment and lead to reduced waste, recycling free from harmful chemicals, and efficient resource utilization.

Adopting existing standards, guidance and tools such as UNEP tools and guidance on chemicals of concerns in electronics developed under the SAICM GEF 9771 project and the Global Industry Standard on Tailings Management may also improve international coordination.

Water pollution

Many sectors have significant impacts on water: for instance, the mining of iron ore for steel causes heavy metal and acid water pollution.[52] The textiles sector is responsible for 9% of annual microfibre pollution to oceans,[53] as when textiles are treated (including dyed or having 'finishes' applied) and washed (including the 'first wash' that occurs at factories, and subsequent washes by consumers), microfibres are released into air and water, and detergents release chemicals into water.

As many industries pollute into the same water bodies, **the most cost-effective solution is to invest in holistic water and wastewater management plans that take into account the entire water cycle: from source to distribution, economic use, treatment, recycling, reuse and return to the environment.**[54] Circular thinking can inspire comprehensive strategies to water and wastewater management, which helps not only the design out of waste and pollution, but also the delivery of resilient services and the regeneration of natural systems. Reducing water use and utilizing water efficiently in alignment with ecosystems regenerative capacity is imperative for long-term sustainability.

While priority should be given to water pollution control approaches that focus on wastewater prevention and minimization over traditional end-of-pipe treatment whenever possible,[55] there are significant benefits to wastewater reuse and recovery of nutrients. When effectively managed, these approaches can mitigate challenges such as water scarcity, groundwater recharge, biogas production while supporting the creation of green jobs. Sustainable nutrient management, particularly for nitrogen, is important, as highlighted in specific UNEA 4 and 5 resolutions[56] [57] on sustainable nitrogen management. For example, re-using treated wastewater can provide a reliable water source for industrial, agricultural and — occasionally — potable uses, often at lower investment costs and with lower energy use than alternative sources, such as desalination or inter-basin water transfers. The International Finance Corporation (IFC) estimates that the cost of producing non-potable recycled water can be as low as US $0.32 per cubic meter, and potable water $0.45, compared with more than $0.50 for desalination.[58] The ILO estimates that, in India, wastewater could annually irrigate 1-1.5 million hectares of farmland and generate 130 million person-days of employment.[59]

For water pollution, the most effective solutions are first, to design products and production processes to prevent pollution from occurring, and then, if pollution is unavoidable, reuse before treatment in industrial symbioses when possible and end-of-pipe water treatment. As treatment at the facility level is often impractical for financial or technical reasons, policies that focus at either the design phase or initiatives aiming at enhancing public wastewater infrastructure are particularly impactful.

In the textiles sector for example, circular interventions to minimize water pollution include:

- Products should be designed in line with circular business models (e.g., clothing made for rental must be durable enough for a higher-than-average washing frequency).[60]
- Businesses should include the consumer 'use' phase in impact evaluations and provide product care recommendations accordingly, to minimize harmful impacts of products during use.[61]
- Textile production sites (especially wet processing sites, raw material extraction and raw material processing sites) should be priorities for support and investment to apply circular production methods that prevent pollution and in substituting polluting machinery.[62]
- Working with production sites and whitegoods' manufacturers on microfibre capture technology to prevent the leakage of microplastics and other water pollutants from washing and treatment of products.[63]

Soil pollution

Pollution to soil is often invisible and difficult to attribute to specific polluters, but has significant consequences for food security, biodiversity, and nature loss, among others, as polluted soil can act as a contamination source for water, air, food, and organisms, including humans.[64] Soil pollution is also closely linked to antimicrobial resistance (AMR) which could have significant impacts on agricultural production, and therefore on economies and food security, particularly in low-income countries. Circular economy practices that preserve and regenerate soil health can also help address AMR as well as address general soil pollution. Left unchecked, antimicrobial resistance could result in a GDP shortfall of US $3.4 trillion annually and push 24 million more people into extreme poverty.[65]

The agriculture sector is particularly dependent on soil health. **Circular approaches (integrated pest management, agroecology, with reduced or no use of antibiotics in animals, fertilisers or pesticides, growing more than one type of crop, and planting trees in combination with crops) can avoid the degradation of 15 million hectares of arable land per year,** while also reducing antimicrobial resistance; the estimated value of this transition is upwards of US $700 billion.[66] UNDESA notes that "circular agriculture with more diversity of production is associated with better health and nutrition, in contrast to export-oriented monocrop production which has often led to increased food insecurity".[67] Cities, which will account for 80% of food consumed by 2050,[68] are key actors to create demand for regenerative and local food production, and build infrastructure to eliminate food waste by leveraging the bioeconomy and converting unconsumed food products and by-products into bioproducts (including new food products, inputs for agriculture, new materials and bioenergy).

To prevent soil pollution, the following circular-based solutions should be considered:

- Recognize the important role of land managers (farmers) in soil management, building on the breadth of sustainable soil management practices available, and the potential for innovative approaches and technologies to rehabilitate and conserve soil health.

- Promote sustainable agricultural practices, develop policies to reduce the use of harmful chemicals and to prevent and control soil pollution, using The Voluntary Guidelines for Sustainable Soil Management. The International Code of Conduct on Pesticide Management and the International Code of Conduct on the Sustainable Use and Management of Fertilizers provide internationally recognized standards for the safe and judicious use of pesticides and fertilizers.

- Build demand for the more expensive bioproducts or encourage the capital investments needed to commercialize bio-based products and solutions.

- Embed nature-based solutions that encourage soil biodiversity into different policies, strategies, action plans, and programmes, which could include existing or planned circular economy policies.[69]

- Enact environmental surveillance on soil to track actual uses and impacts (including gender impact assessments) to identify appropriate sites for circular-based soil solutions.[70]

- Leverage city-level policies to encourage circular agriculture approaches (e.g., government support that facilitates connecting circular businesses with high-density city populations, such as facilitating operations for businesses that encourage food redistribution – this includes businesses that sell at a discount or donate unsold food or 'ugly' produce to avoid food waste, as well as those advancing infrastructure to collect food by-products or discarded food for compost or biofuel).[71]

Air pollution

Household heaters and stoves, motor vehicles and industrial facilities are the most common sources of air pollution, which can cause respiratory and other diseases[72]– with low- and middle-income countries being exposed to the highest levels. [73] Energy-intensive sectors and processes (such as for construction[74]) can have impacts on air pollution as well as climate change, depending on their energy mix. The construction and building sector is also a significant consumer of environmentally impactful raw materials, such as concrete, which is second only to water as the most consumed resource in the world[75] and in addition to its climate impacts, produces air pollutants such as SO2, NOx, and CO that are linked with health impacts. [76]

Policies that take a holistic and circular approach to urban planning can reduce pollution from buildings, particularly to air and water, including encouraging high-density and mixed-use urban living, monitoring the production of pollutions such as airborne emissions to inform resource efficiency strategies, and channelling infrastructure budgets towards sustainability.[77] Public transport can also encourage high-density urban living while reducing air pollution; it is estimated that Bogota's Bus Rapid Transit System resulted in a five-fold reduction in equivalent black carbon and a four-fold reduction in fine particulate pollution.[78] Urban populations are predicted to increase to nearly 70% by 2050.[79] There is a clear need to encourage circular building material choices and designs, to prefer sustainable renewable materials that can sequester carbon and be managed sustainably over their life cycle.[80]

The following circular practices can help mitigate air pollution:

- Revalorizing industrial waste: concrete, as one of the world's most common building materials, has particular potential in revalorising industrial waste (such as fly ash from coal-fired power plants, cement kiln dust and granulated blast-furnace slag, thus removing potential air pollutants) and integrate it in its production.[81] Efforts to connect waste producers with materials producers through industrial symbiosis for instance, as well as the development of safety standards for these processes are essential.

- Circular production of building materials (such as bricks) can not only minimize air pollution (such as black carbon and other short-lived air pollution), but also offers the opportunity to address informal and child labour present in building material production, [82] through coordinated and joint responses between labour and environmental actors.[83]

- Incorporating nature-based solutions into circular design that reduces pollution, such as 'using new assemblages of organisms for green roofs and walls to mitigate city warming and clean polluted air'.[84]

4 Accelerating global action towards a pollution-free planet through the circular economy

The WTO Trade and Environmental Sustainability Structured Discussions (TESSD) is a Member-led initiative launched in December 2021, which provides a forum to exchange on thematic issues, including through a "Working Group on Circular Economy-Circularity" to discuss:

- What trade policies, tools and collaborative actions can support the transition to a circular economy that supports the achievement of sustainable development goals?
- What trade policies, tools and collaborative actions could help developing and least developed countries ensure that circular economy approaches contribute to their sustainable development?
- What are the lessons learned from existing efforts to advance circular economy goals (including reducing unsustainable resource use, promoting resource efficiency, sustainability and safety across product lifecycles, restoring and regenerating ecosystems, and minimising waste) and the opportunities and challenges linked to trade and trade policies?

In 2022, the Working Group on Circular Economy conducted a mapping exercise that identified existing trade measures, e.g. bans, licenses, technical regulations, related to circular economy to improve the understanding of the relevance of trade and trade policy across life cycle stages. The mapping exercise also identified trade measures on activities such as: i) reducing resource consumption, ii) promoting sustainable materials, iii) substitution of non-renewable resources, iv) repair and remanufacturing, v) reuse and recycling, vi) waste-to-energy conversion, vii) sound management of hazardous substances and waste, viii) technology and R&D in circular economy, and ix) enhanced transparency on material composition.

TESSD discussions provide a strategic entry point for GACERE member countries to share their experience and feed into on-going discussions on trade measures which are required to facilitate the adoption of circular practices at regional and global levels.

Multilateral conventions on pollution

Of the seven commonly cited multilateral conventions on pollution, [85] none features language on the potential of "circular economy" as a solution. In the implementation of these conventions, current efforts are nonetheless ongoing to create linkages between different agendas. the Joint Task Force on Programmatic Cooperation on Chemicals and Waste (comprised of UNEP, and the secretariats of the Basel, Rotterdam and Stockholm conventions, the Minamata Convention and the Strategic Approach to International Chemicals Management (SAICM))'s Beyond 2020 framework have explored linkages with 'broader agendas on the environment and sustainable development, such as the pollution agenda, sustainable lifestyles, circularity and cities'. [86]

There are opportunities for GACERE member countries to inform discussions by sharing good practices, and encourage the adoption of circular solutions while engaging in "multisectoral cooperation in the context of meeting obligations of the multilateral environmental agreements". [87]

Public-private dialogue

Public-private dialogue is an important feedback loop for inspiring circular solutions against pollution to ensure that policies do not have negative unintended impacts on livelihoods or social protections. Market incentives encouraging the adoption circular economy practices will be powerful in reducing pollution. In the meantime, it is critical policymakers give businesses confidence and visibility that their circular efforts will be sustained and supported in the long term, through policy continuity. Lack of harmonization of regulations contributes to uncertainty and stresses on market access, particularly for SMEs with limited compliance resources.

To that end, policymakers can also advance the development of international standards for circularity (such as the planned ISO standard for circular economy) [88], which can also help ensure that views from across regions and across the value chain are represented.

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ABOUT GACERE

Bringing together governments and relevant networks and organisations, the Global Alliance on Circular Economy and Resource Efficiency (GACERE) aims to provide a global impetus for initiatives related to the circular economy transition, resource efficiency and sustainable consumption and production, building on efforts being deployed internationally. GACERE members will do so by working together and advocating at the political level and in multilateral fora, in particular at the United Nations General Assembly (UNGA), the United Nations Environment Assembly (UNEA) and in G7/G20.