



Entrepreneurs Riding the Wave of Circularity

Series No. 03



The New Frontier in Entrepreneurship

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Circularity as a new economic model

The world is changing and so are business models. As the planet faces major challenges of climate change and biodiversity loss, as well as rising energy costs, the number of entrepreneurs adopting the circular economy as a business model is increasing. The transition from a linear, take-make-waste model towards a regenerative, circular one is taking place as today's global production and consumption model is becoming more and more unsustainable.

Every year, more than 100 billion tons of raw materials are extracted and transformed into manufactured products.¹ This constant process results in pollution of the atmosphere, threatens biodiversity, degrades land, and brings us close to the depletion of irreplaceable natural resources. The extraction and transformation of natural resources is also responsible for more than half of global greenhouse gas emissions, a primary driver of global warming.² Only 8.6 per cent of these resources re-enter the economic cycle, resulting each year in the dumping of more than 2 billion tons of waste.^{3,4} With the continuous growth of the global population, pollution and waste are expected to keep increasing.⁵

At the core of a circular economy is the creation of a balanced product and service development process that prioritizes the responsible management of natural resources and minimizes the impact on the environment. The circular business model aims to restore and maximize the reuse, remanufacturing, recycling and recovery of products and waste materials, while promoting practices that regenerate nature and preserve biodiversity.⁶ It thus promotes the design of products, services, methods of production and business models that prioritize closed material loops and the preservation of natural capital.⁷

The impact of the circular economy can be phenomenal. For instance, estimates for key industries such as steel, aluminium, cement, plastic and food show that annual greenhouse gas emissions could diminish by 9.3 billion tons of CO₂ equivalent by 2050,⁸ a 23 per cent decrease compared to 2021 levels.⁹

At the same time, the circular economy is becoming more and more economically lucrative. The transition to a circular economy could unlock up to \$4.5 trillion in economic growth and create more than seven million jobs worldwide by 2030.^{10,11} For example, a joint study conducted by UNCTAD and the Ellen MacArthur Foundation reveals a \$624 billion potential by 2050 within India's economy alone if it adopts circular economy principles.¹² A similar assessment conducted in 2018 for China projected savings of approximately \$10.3 trillion by 2040, the equivalent to 16 per cent of China's projected GDP.¹³

¹ Circularity Gap Reporting Initiative, 2021, *Circularity Gap Report 2021*, <https://www.circularity-gap.world/2021>.

² Ibid.

³ Ibid.

⁴ S Kaza, LC Yao, P Bhada-Tata and F Van Woerden, *What a Waste 2.0* (Washington, D.C., World Bank), <https://doi.org/10.1596/978-1-4648-1329-0>.

⁵ United Nations Environment Programme, 2011, *Decoupling Natural Resource Use and Environmental Impacts from Economic Growth*, International Resource Panel, <https://www.resourcepanel.org/reports/decoupling-natural-resource-use-and-environmental-impacts-economic-growth>.

⁶ UNCTAD, 2018, *Circular Economy: The New Normal?*, UNCTAD Policy Brief No. 61.

⁷ United Nations Economist Network, 2023, *New Economics for Sustainable Development: Circular Economy*, United Nations Policy Brief, <https://www.un.org/en/desa/unen/policy-briefs>.

⁸ Ellen MacArthur Foundation, 2021, *Unlocking the value of the circular economy*, <https://ellenmacarthurfoundation.org/articles/unlocking-the-value-of-the-circular-economy>, 15 June.

⁹ According to the International Energy Agency (IEA), total greenhouse gas emissions reached 40.8 Gt of CO₂ equivalent in 2021. See IEA, 2022, *Global Energy Review: CO₂ Emissions in 2021*, <https://www.iea.org/reports/global-energy-review-co2-emissions-in-2021-2>.

¹⁰ Organisation for Economic Co-operation and Development (OECD), 2020, *The Circular Economy in Cities and Regions: Synthesis Report*, OECD Urban Studies (OECD Publishing), <https://doi.org/10.1787/10ac6ae4-en>.

¹¹ International Labour Organization (ILO), 2023, *Decent Work in the Circular Economy: An Overview of the Existing Evidence Base*, https://www.ilo.org/sector/Resources/publications/WCMS_881337/lang-en/index.htm.

¹² UNCTAD, 2016, *Circular economy principles could help India realise \$624bn*, <https://unctad.org/news/circular-economy-principles-could-help-india-realise-624bn>, 5 December.

¹³ UNCTAD, 2018, *China's cities can lead the global transition to a circular economy*, <https://unctad.org/news/chinas-cities-can-lead-global-transition-circular-economy>, 27 September.

Business areas that can benefit most are product and service design, sustainable production processes, forward-thinking business models, and technological innovations that could significantly boost the efficiency and sustainability of supply chains.

Entrepreneurs play a catalytic role in driving the transformation towards circularity. As agents of innovation, they introduce new products, services, methods of production and business models by identifying opportunities that respond to emerging needs. Through their willingness to take risks, entrepreneurs embrace uncertainties and invest efforts, time and resources in creating innovative solutions capable of disrupting markets, paving the way for new attitudes and business practices across industries.

This publication identifies key opportunities and challenges in the transition to a circular economy and showcases inspiring examples of entrepreneurs managing small and medium-sized enterprises (SMEs) and tech start-ups that are advancing this new economic model in local communities. It also highlights policy initiatives to support entrepreneurial innovations and aims to encourage more business-led initiatives for a circular economy with a special focus on developing countries.

By addressing environmental challenges, mainstreaming circularity in innovation and business models can greatly contribute to multiple United Nations Sustainable Development Goals (SDGs) such as SDG 7 (clean energy), 8 (decent work and economic growth), 9 (innovation), 12 (responsible consumption and production), 13 (climate change), 14 (oceans) and 15 (life on land). It can also contribute to SDG 17 (partnerships) by bringing different stakeholders to collaborate through collaborative communities, platforms and spaces, as reflected in this publication.

The United Nations formally recognizes entrepreneurship as a key ingredient in development through a series of General Assembly resolutions on entrepreneurship for sustainable development since 2012.¹⁴ UNCTAD, the United Nation's body on trade and development, provides policy advice to governments and capacity-building in support of micro, small and medium-sized enterprises (MSMEs) and start-ups,¹⁵ in line with the 2030 Agenda for Sustainable Development.

A transition propelled by entrepreneurial innovations

Innovation is an instrumental part of the circular economy. It often helps develop a niche market or meet a local need before it disseminates to a larger market. For instance, online sharing platforms for agricultural tools or machineries such as tractors, or do-it-yourself tools are good examples. Instead of each individual purchasing new products, entrepreneurial innovation facilitates product sharing on a need basis. Another example is the waste management industry in some developing nations, where small-scale initiatives have emerged, often led by the informal sector, that have eventually given rise to more efficient and formal businesses as demand for these services have increased.

Innovation is closely connected to research and development (R&D). By setting up R&D clusters that bring together educational institutions, research centres, entrepreneurs and public sectors, entrepreneurial innovation can be stimulated. This multi-stakeholder collaboration has the potential to fuel the integration of cleaner industrial processes and creative methods to effectively utilize renewable resources in value chains. For example, R&D can catalyse innovation to uncover methods to convert food waste into biogas for energy generation or to explore ways to transform plastic waste into valuable resources, such as building materials or fuel.

¹⁴ United Nations, General Assembly, 2022, Entrepreneurship for sustainable development, A/RES/77/160, agenda item 18, supp. no. 49, 27 December, adopted 14 December.

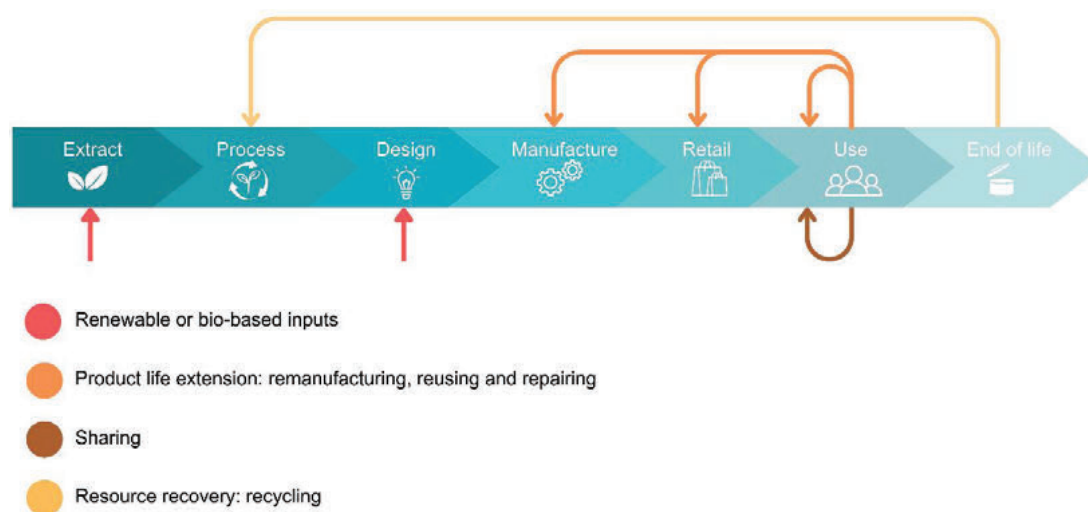
¹⁵ UNCTAD, 2021, The Bridgetown Covenant: From inequality and vulnerability to prosperity for all, Virtual Barbados, fifteenth session 3–7 October, paragraph 127r, TD/541/Add.

In this regard, the circular economy can bring about a new world of opportunities, especially for SMEs and start-ups. Thanks to their smaller size, they can be more flexible than large corporations, are close to customers' feedback and can often more easily adapt to changing market environments by introducing new products and services and management systems. As such, they can be a vital conduit for implementing and spreading innovations.¹⁶

SMEs can have a huge impact in the transition to the circular economy. Collectively, they account for more than 50 per cent of global greenhouse gas emissions,¹⁷ represent 90 per cent of all businesses worldwide,¹⁸ and are responsible for over two thirds of employment.¹⁹ By adopting circular principles, SMEs can induce mindset changes at the local level and create a ripple effect within supply chains, in which they are key players. Hence, developing industry-specific approaches to encourage SMEs to adopt circular principles can have a great impact in facilitating the transition.

While the concept of circular economy is often reduced to recycling and waste management, circular innovations can take form in a much broader framework as illustrated in the figure below. Products and material components can be circulated by using repairing, reusing and remanufacturing techniques and establishing sharing models, and when the product or material components cannot be used for longer, they can be recycled. For products and inputs that can easily biodegrade, such as food or other biological materials, they can be reintroduced to the soil through composting and regenerative farming practices, which helps fuel the supply of bio-based inputs.²⁰

Circular business models in a linear product life cycle



Source: Adapted from OECD (2019).²¹

¹⁶ L Cusmano, M Koreen and L Pissareva, 2018, 2018 OECD Ministerial Conference on SMEs (OECD Publishing), <https://doi.org/10.1787/90c8823c-en>.

¹⁷ International Trade Centre, 2021, *SME Competitiveness Outlook 2021: Empowering the Green Recovery*, <https://intracen.org/resources/publications/sme-competitiveness-outlook-2021-empowering-the-green-recovery>.

¹⁸ ILO, 2019, *Small Matters: Global Evidence on the Contribution to Employment by the Self-employed, Micro-enterprises and SMEs*, https://www.ilo.org/global/publications/books/WCMS_723282/lang-en/index.htm.

¹⁹ Ibid.

²⁰ Ellen MacArthur Foundation, <https://ellenmacarthurfoundation.org/eliminate-waste-and-pollution>.

²¹ OECD, 2019, Circular business models, in *Business Models for the Circular Economy: Opportunities and Challenges for Policy* (OECD Publishing), <https://doi.org/10.1787/e59f8dd6-en>, 23–40.

Product life extension and circular design

Remanufacturing, reusing and repairing are effective ways to extend the useful life of products that can simultaneously reduce waste and the pressure on virgin natural resources.²² For example, estimates in the textile industry show that by increasing clothing durability and the reuse or remanufacturing of used clothes the potential exists to reduce up to 33 per cent of the CO₂ emissions associated with textile production.²³

Some entrepreneurial initiatives have focused on improving the complex reverse chain logistics, that is, the recovery of packaging and waste material to be reused into new non-virgin raw materials. This can be achieved by, for example, harnessing the potential of information and communication technology (ICT) and advanced information systems to enhance the connectivity between producers and disposal actors, thereby streamlining product traceability. Reverse chain logistics can also extend to interactions with customers. For example, some business models have introduced incentives and facilities for customers to return products at the end of their useful life for their reuse (see box 1). These improvements can enhance the resilience of the supply chain and support the effective reintroduction of waste into the value chain for an upgraded circular industry.²⁴

In this context, it becomes essential to incorporate circularity in the early stages of the product design to facilitate the subsequent circulation of products and material components across the supply chain. This includes the need to rethink the choice of materials; the design of products so that they can be easily reused, disassembled and remanufactured; and simultaneously establish efficient systems to recover products at the end of their life cycle.

For example, in the construction sector many waste materials generated from demolitions and renovation works are unsuitable for their reuse or recycling. It is estimated that this sector alone creates around a third of the world's waste.²⁵ This can be reduced by, for instance, adopting a scheme of standard-size components for disassembly and adaptability, which in turn could optimize both the service life and the lifespan of these materials, providing an avenue for entrepreneurs to innovate in this direction.

The use of data is also fuelling the adoption of circular practices in businesses. Data systems can be utilized to improve the efficiency of product components rotation, support their traceability and maximize their reuse or remanufacture. The European Commission has proposed such a solution through the implementation of digital product passports as a tool to foster circularity. The aim is to facilitate companies to keep track of products and components from their design to the end of their life cycle.²⁶ Start-ups are also developing new technologies to track materials along the supply chain. Haelixa, for example, has designed a marker tracing technology that allows the materials of products to be traced and authenticated along the supply chain (see box 1). By enhancing material traceability, these types of technologies contribute to the circular economy by boosting supply chain transparency and fostering the reliability needed to reintroduce materials into the value chain.

Box 1. Innovative approaches to circular design and product life extension

MoreLoop is a Thai company focused on reducing the fashion industry's environmental impact by offering two main strategies in its business model, namely: (a) it sells surplus fabrics through the company's online marketplace, helping designers and manufactures source sustainable materials

²² Ellen MacArthur Foundation, The technical cycle of the butterfly diagram, <https://ellenmacarthurfoundation.org/articles/the-technical-cycle-of-the-butterfly-diagram>.

²³ UNCTAD, 2021, Seizing the opportunities of a circular economy in textiles, <https://unctad.org/news/seizing-opportunities-circular-economy-textiles>, 28 June.

²⁴ Ibid.

²⁵ M Miller, 2022, The industry creating a third of the world's waste. BBC Future Plante, <https://www.bbc.com/future/article/20211215-the-buildings-made-from-rubbish>, 28 February.

²⁶ World Business Council for Sustainable Development and Boston Consulting Group, 2023, The EU Digital Product Passport shapes the future of value chains: What it is and how to prepare now, <https://www.wbcsd.org/Pathways/Products-and-Materials/Resources/The-EU-Digital-Product-Passport>.

while reducing textile waste; (b) it utilizes upcycling practices by transforming surplus fabrics into new products, minimizing its environmental footprint by giving discarded textiles a new life. Through its online marketplace, MoreLoop serves as a link in the reverse supply chain, connecting textile companies with manufacturers.²⁷ As of 2022, approximately 70 textile companies in Thailand have partnered with MoreLoop, using the platform to sell their excess fabric. In turn, around 150 manufacturers buy these fabrics to create unique items of clothing.²⁸

Loop is a United States of America-based reuse global platform that promotes replacement of disposable single-use packaging with long-lasting ones with the aim of contributing to a zero-waste future. The concept, developed in 2019, involves upgrading single-use product containers to refillable versions, collecting them and returning them to producers for replenishment. A mobile app helps users find return points and keep track of the impact generated.²⁹

The Chilean start-up Algramo tackles the problem of plastic waste by developing affordable packaging that enables consumers to purchase products in reusable containers. In collaboration with brands from leading global consumer goods companies, container reuse is quantified with smart product dispensers that recognize empty containers. According to Algramo, more than 900,000 containers have been reused since 2020, avoiding more than 100,000 kg of plastics becoming waste.^{30,31}

Haelixa, a Swiss start-up, has developed a DNA-based marker system that allows the tracking of materials in products and raw materials throughout the entire product life cycle. The markers are introduced as a liquid formulation incorporated into materials, using automated spray systems, at the very beginning of the value chain. The markers can thus be integrated into industrial-scale production processes or raw materials and the system is applicable to industries such as precious metals, cotton crops and textiles, and the agricultural sector. Each marker works as a quality label that cannot be removed or altered, providing an identification for individual farms, manufacturers or product batches. At any point of production, the product can be submitted to tracking, ensuring an end-to-end supply chain control. This tracking system helps guarantee that the purchased item is associated with sustainable or ethical practices, promoting transparency, confidence and reliability of supply chains.³²

From trash to treasure: Waste management and resource recovery

Integrating recycling practices at the end of a product's life offers another solution to reintegrate material resources into the cycle while reducing the quantity of waste disposed.³³ With the significant volume of waste that is currently generated, including plastic, glass and electronic waste, the development of efficient recycling processes and waste management systems presents an opportunity to reintroduce resources into the value chain. This not only promotes higher sustainability of resources but also unlocks potential income streams from these reclaimed materials.

For example, the value of gold and silver that can be found in electronic scrap can reach \$21 billion annually, but less than 15 per cent is recovered.³⁴ In the case of plastics, the collection and recycling of PET bottles can produce important income streams for waste pickers if properly organized. Estimated figures in the Philippines show that waste pickers could increase their income by seven times if they focused on collecting and selling PET bottles, compared to only plastic bags.³⁵

²⁷ Moreloop, Make circular economy a reality, <https://moreloop.ws/>.

²⁸ G Vollmer, 2022, New clothes from old fabric scraps, <https://p.dw.com/p/48dKJ>, 24 March.

²⁹ Loop, A global platform for reuse, <https://exploreloop.com/>.

³⁰ Algramo, <https://algramo.com/>.

³¹ United Nations Environment Programme, 2023, The Chilean start-up changing our relationship with plastic, <https://www.unep.org/news-and-stories/story/chilean-start-changing-our-relationship-plastic>, 17 May.

³² Haelixa, <https://www.haelixa.com/>.

³³ Ellen MacArthur Foundation, The technical cycle of the butterfly diagram, <https://ellenmacarthurfoundation.org/articles/the-technical-cycle-of-the-butterfly-diagram>.

³⁴ H Engel, M Stuchtey and H Vanthoumout, 2016, Managing waste in emerging markets, McKinsey & Co., <https://www.mckinsey.com/capabilities/sustainability/our-insights/managing-waste-in-emerging-markets>, 17 February.

³⁵ McKinsey Center for Business and Environment and Ocean Conservancy, 2015, *Stemming the Tide: Land-based Strategies for a Plastic-free Ocean*, oceanconservancy.org.

Organizing effective waste collection and resource recovery systems can be challenging in many developing nations. In rapidly growing economies, population growth puts pressure on traditional waste management systems, resulting in increasing amounts of waste often being uncollected and untreated. Waste management can amount to the largest budgetary expenditure in low-income countries, where, on average, it can easily reach 20 per cent of municipalities' budgets.³⁶ These costs can become economically unfeasible to bear in remote regions due to the high transportation costs to centralized waste management facilities.³⁷

In response to these challenges, some communities have opted for decentralized waste management systems.³⁸ Here, small waste management centres and shops located in communities take responsibility for creating collection points and handling municipal solid waste, replacing inefficient waste transportation to a central hub for processing and disposal.³⁹ This approach can contribute to the creation of economically viable business models with the potential to create jobs and attract investment in local waste management infrastructure. As detailed in box 2, some entrepreneurial initiatives have successfully organized waste management systems at the local level by implementing creative door-to-door waste collection schemes and utilizing technologies to efficiently segregate the increasing volume of waste.

Box 2. Turning waste into sustainable social and economic solutions

Kabadiwalla Connect is an Indian tech-driven start-up that helps integrate the informal waste-picking sector in the formal collection and processing of waste. This integration is made possible using ICT and Internet of things (IoT) technologies. With IoT-enabled smart bins integrated into cities, linked to local scrap shops and waste pickers, and complemented by user-friendly computer applications for waste pickers, Kabadiwalla Connect offers municipalities an efficient waste management solution that integrates the key role of the informal sector.⁴⁰

Nigeria's social enterprise Wecyclers aims at addressing the challenge of urban waste in Lagos by providing low-income communities with an incentive scheme for recycling. Using low-cost cargo bikes called "wecycles", the company collects recyclable waste materials from local service subscribers, sorts and sells them to manufacturers for their later transformation into new items. To incentivize the waste collection, Wecyclers rewards households by exchanging the recyclable waste with basic goods such as food and household items, offering a simple and accessible form of income or resources.⁴¹

Founded in 2018, India's Ishitva Robotics Systems is a start-up that harnesses "industry 4.0" technologies, including artificial intelligence (AI), machine learning and IoT, to develop intelligent waste sorting systems. These systems automatically segregate various types of plastics, such as PET, PP and HDPE, as well as other non-organic waste such as metal cans. These solutions also utilize the data gathered, including usage patterns and collection times in different areas, to enable efficient monitoring and management of the entire waste collection process. The technology developed by Ishitva Robotics primarily benefits recycling companies by establishing effective material recovery facilities.⁴²

The circular economy model can also present opportunities for the informal sector. For example, in developing nations, informal waste collectors and recyclers can be integrated into the formal systems of urban waste management.⁴³ Some public initiatives have taken place to formalize waste-picking activities, while simultaneously ameliorating the harsh working conditions of

³⁶ S Kaza, LC Yao, P Bhada-Tata and F Van Woerden, 2018, *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050* (Washington, D.C., World Bank), <https://doi.org/10.1596/978-1-4648-1329-0>.

³⁷ G Vinti and M Vaccari, 2022, Solid waste management in rural communities of developing countries: An overview of challenges and opportunities, *Clean Technologies*, 4(4), <https://doi.org/10.3390/cleantechnol4040069>.

³⁸ D Storey, L Santucci, J Aleluia and T Varghese, 2015, Decentralized and integrated resource recovery centers in developing countries: Lessons learnt from Asia-Pacific (Economic and Social Commission for Asia and the Pacific).

³⁹ W Rodrigues and V Pahwa, 2023, Reducing waste is critical for building a circular economy: Here's how local solutions can get us there (World Economic Forum), <https://www.weforum.org/agenda/2023/02/tackling-waste-is-critical-for-building-a-circular-economy-and-the-solution-is-local/>, 24 February.

⁴⁰ Kabadiwalla Connect, <https://www.kabadiwallaconnect.in/>.

⁴¹ Wecyclers, <https://www.wecyclers.com/>.

⁴² Ishitva Robotic Systems, <https://ishitva.in/>.

⁴³ H El Bari and C Trois, eds., 2023, *Waste Management in Developing Countries* (Springer International Publishing series Waste as a Resource), <https://doi.org/10.1007/978-3-031-28001-6>.

waste pickers and supporting the creation of new jobs. In Brazil, through the National Policy of Solid Waste, the government recognized the contribution of informal waste collectors, known under the name of *catadores*, in the country's recycling industry by integrating them in the local waste management systems and assisting them to become formalized as cooperatives.⁴⁴ The integration of informal waste pickers in municipality-led initiatives could be mutually beneficial. Their collaboration can lead to new commercial opportunities, in addition to improving the economic situation of the waste pickers and reinforcing the activities of municipalities towards environmental sustainability.⁴⁵

Optimizing the use of goods through service-based and sharing business models

Start-ups are revolutionizing consumer experiences with fresh and innovative service offers. One such example is the product-as-a-service business model, which departs from traditional product sales whereby companies provide their products as services through pay-per-use or pay-for-a-specific-outcome arrangements, while still keeping the ownership of the product.⁴⁶ This model can promote circularity by reducing both excessive goods production and idle resources. The retention of product ownership further serves as an incentive for companies to prolong the product's useful life through a focus on repairability and upgrades. This model can also support financially constrained individuals by offering more affordable and sustainable options to users.⁴⁷

For example, instead of buying costly solar panels, households and businesses can access solar energy as a service. A company installs and maintains solar panels on buildings, while users pay a fee for the service and electricity generated. In the United Republic of Tanzania, ZOLA Electric is an example of such models (see box 3). In the field of transportation, some start-ups have provided affordable and more sustainable options for trips within cities such as bicycles, cars or buses on demand (such as Bolt, Uber or Swval). This model, however, is moving beyond personal transit. New transportation-as-a-service start-ups are emerging in the business sector as well. Start-ups like Volta Trucks, further mentioned in box 3, are changing how businesses consider logistics and supply chain operations, introducing sustainable transportation alternatives and reinforcing their commitment towards achieving net-zero emission targets.

Close to this model are sharing business models, in which start-ups maximize the use of products, often those that are idle or underutilized, thereby creating environmentally sustainable and profitable activities.⁴⁸ As for product as a service, these sharing business models facilitate access to products or services on an as-needed basis. They differ in that they involve peer-to-peer or, consumer-to-consumer exchanges, usually through a digital platform.⁴⁹

Start-ups like Hello Tractor, also described in box 3, are examples of how these business models facilitate communities to group together and share a pool of tools, resources or products, providing affordable access and generating extra income for owners, while increasing social contact and fostering a circular economy within local communities.

Box 3. Start-ups moving into sharing and service-based business models

ZOLA Electric was launched in the United Republic of Tanzania in 2011 with the mission of addressing energy inequality. Its business model proposes affordable renewable energy to households through a

⁴⁴ UNCTAD, 2022, Urban Expansion, an Entrepreneur's Playground, https://unctad.org/system/files/official-document/diaeinf2022d1_en.pdf.

⁴⁵ H El Bari and C Trois, eds., 2023, *Waste Management in Developing Countries* (Springer International Publishing series Waste as a Resource), <https://doi.org/10.1007/978-3-031-28001-6>.

⁴⁶ Stena Circular Consulting and Cradlenet, 2022, Product-as-a-Service in the Circular Economy: The Nine Critical Challenges and How To Fix Them, https://www.stenarecycling.com/siteassets/documents-and-downloads/documents/en/product-as-a-service-in-the-circular-economy_report-2022.pdf.

⁴⁷ Ibid.

⁴⁸ OECD, 2019, Circular business models, in *Business Models for the Circular Economy: Opportunities and Challenges for Policy* (OECD Publishing), <https://doi.org/10.1787/e59f8dd6-en>, 23–40.

⁴⁹ Ibid.

pay-as-you-go system. This financially innovative system allows electricity services to be accessible for as low as \$0.19 a day, making it affordable for 80 per cent of Tanzanian households.⁵⁰ ZOLA Electric's model stands out from traditional models as it not only designs and manufactures solar systems but also installs and maintains them. By facilitating the transition to solar energy, increasing the efficiency and lifespan of the installations, it contributes to the circular economy with power systems that last over a decade.⁵¹

Volta Trucks is an innovative start-up that allows companies to integrate electric transportation into their operations for a monthly fee. This transport-as-a-service model extends beyond providing electric vehicles. The company offers a package that includes the installation of the charging infrastructure, routine vehicle maintenance, personnel training and insurance services. This allows Volta Trucks to take full responsibility for repairing and recycling the vehicles, while supporting companies to transition towards sustainable transportation.⁵²

Hello Tractor is a sharing-based platform that is used in Kenya and Nigeria to enable farmers owning tractors to share them with other farmers. The start-up assists tractor owners in earning extra income by ensuring that tractors are in use rather than left idle. Through a mobile and online app, its platform provides seven technology features (GPS tracking, fuel monitoring, operator functionality, maintenance function, farmer bookings, work completed and fleet management) that allow for a more efficient flow of tractors and coordination among the ecosystem of participants, including tractor owners, tractor operators and farmers.⁵³

Harnessing bio-based inputs

The transition from a linear to a circular economy emphasizes restoring nature, including improving soil health and promoting biodiversity. Carefully selecting sustainable materials and using resources more efficiently by reducing the reliance on virgin, non-renewable and limited resources and replacing them with eco-friendly alternatives such as renewable, recycled or biodegradable materials can contribute to this aim.

In the textile industry for instance, entrepreneurial initiatives have started testing innovative technologies that use less-polluting chemical alternatives and circular production processes. These include replacing fossil fuel oil-derivative fabrics with those made from plant seed oils or other bio based materials, using agricultural waste to create natural dyes, and introducing efficient production processes that minimize the use of water.^{54,55,56} Other recent innovations include the shift towards bioplastics to reduce the dependence on oil-based plastic. This involves sourcing materials from non-polluting sources such as sugarcane, yeast, wood and food waste.⁵⁷

The circular supply of bio-based inputs is particularly important in the agricultural sector. Current agricultural practices rely heavily on fertilizers, pesticides and fossil fuels, and consume 70 per cent of water worldwide, significantly contributing to shortages of water, pollution, soil degradation and biodiversity loss.^{58,59} Opportunities exist to develop innovative technologies and design processes that are more efficient in the use of resources, that create new jobs, generate revenue and ensure food security. For example, in resource-constrained

⁵⁰ United Nations Framework Convention on Climate Change, ZOLA Electric | Tanzania, 2023 UN Global Climate Action Awards, <https://unfccc.int/climate-action/momentum-for-change/financing-for-climate-friendly/off-grid-electric>.

⁵¹ Zola Electric, <https://zolaelectric.com/>.

⁵² Volta Trucks, <https://voltatrucks.com/>.

⁵³ Hello Tractor, <https://hellotractor.com>.

⁵⁴ Beyond Surface Technologies AG and miDori, <https://www.beyondst.com/>.

⁵⁵ Archroma, EarthColors®, a new method of creating warm shades from nature, <https://www.archroma.com/innovations/earth-colors-by-archroma>.

⁵⁶ Archroma, 2016, Archroma to showcase innovative solutions for enhanced color, performance and sustainability at China Interdye 2016 in Shanghai (Archroma press release), <https://www.archroma.com/press/releases/archroma-to-showcase-innovative-solutions-for-enhanced-color-performance-and-sustainability-at-china-interdye-2016-in-shanghai>, 13 April.

⁵⁷ N Singh, OA Ogunseitan, MH Wong and Y Tang, 2022, Sustainable materials alternative to petrochemical plastics pollution: A review analysis, *Sustainable Horizons*, 2:100016, <https://doi.org/10.1016/j.horiz.2022.100016>.

⁵⁸ Ellen MacArthur Foundation, Regenerate nature, <https://ellenmacarthurfoundation.org/regenerate-nature>.

⁵⁹ OECD, 2020, Water and Agriculture, Agriculture Policy Brief (OECD Publishing), https://issuu.com/oecd.publishing/docs/water_and_agriculture.

environments, small-scale farmers are introducing composting techniques where fertilizers are not accessible, using organic waste as the input material to enhance the soil's quality and secure agricultural production.⁶⁰

Agricultural entrepreneurs, or “agripreneurs”, are also leading the way in implementing circular economy principles to manage farms, forests or fisheries. As showcased in box 4, agripreneurs invest in innovative processes to minimize soil degradation and the use of natural resources such as water, for example through enhanced seaweed farming. They collaborate with scientists to innovate in promising fields and techniques such as plant breeding, with the shared goal of enhancing beneficial crop traits. These include increasing resistance to pests and diseases, improving crop yield and ensuring food security.⁶¹

These agripreneurs serve as vital agents of change within their local communities. They encourage other agribusinesses along the value chain to move towards organic and regenerative practices, while simultaneously addressing local socioeconomic and environmental challenges (see box 4). Their activities demonstrate that the move towards circular practices is not just a necessity and strategic for the future of sustainable agriculture, but also an economically viable alternative.

Box 4. Agripreneurs boosting circularity in agricultural supply chains

Thailand's Happy Grocers is a social enterprise that aims to revolutionize the food supply chain in the country by increasing the accessibility of sustainable products to customers while ensuring fair compensation for farmers engaged in sustainable practices. The business model establishes a direct link between consumers and agribusinesses committed to sustainable agricultural practices such as, for example, using biological fertilizers derived from organic waste. The start-up works with farmers and food waste management workers going beyond just transactions. It provides them with training on technology-based farming practices and sustainable agriculture methods, such as organic farming practices, that are resource efficient and support the regeneration of nature, aligning with circularity principles. Additionally, it empowers potential female entrepreneurs to start their businesses by offering educational and start-up seminars.^{62,63}

Samudra Oceans, a start-up based in the United Kingdom of Great Britain and Northern Ireland, is scaling up seaweed farming production through the application of AI and robotics, with the aim of increasing the pace of carbon sequestration. Seaweed can serve multiple purposes, ranging from food production and cosmetics to biofuel generation, and can be used as an alternative to plastic.⁶⁴ Seaweed farming has the distinct ability to grow without requiring fresh water or fertilizer,⁶⁵ while capturing CO₂ at a rate 20 times higher than terrestrial trees.⁶⁶ This makes it a strong solution for mitigating climate change while contributing to a circular economy by optimizing the use of natural resources and feeding the supply of bio-based inputs for multiple industries. Moreover, traditional seaweed farming is labour intensive, with 70 per cent of costs allocated to labour and recurrent boat trips.⁶⁷ By deploying robotics equipped with sensors and cameras, Samudra Oceans can monitor cultivation and track biomass growth more efficiently. Its technology reduces the costs but also helps seaweed farms to expand their capacities.

⁶⁰ A Reetsch, DN Kimaro, K Feger and K Schwärzel, 2020, Traditional and adapted composting practices applied in smallholder banana-coffee-based farming systems: Case studies from Kagera and Morogoro Regions, Tanzania, in H Hettiarachchi, S Caucci and K Schwärzel, eds., *Organic Waste Composting through Nexus Thinking* (Springer), https://doi.org/10.1007/978-3-030-36283-6_8, 165–184.

⁶¹ World Economic Forum, 2018, Bio-innovation in the Food System: Towards a New Chapter in Multistakeholder Collaboration, <https://www.weforum.org/whitepapers/bio-innovation-in-the-food-system-towards-a-new-chapter-in-multistakeholder-collaboration/>, 21 September.

⁶² SEED, Happy Grocers: Creating a sustainable food system in Thailand (2021 SEED Low Carbon Award), <https://seed.uno/enterprise-profiles/happy-grocers>.

⁶³ Happy Grocers, About Happy Grocers, <https://happygrocers.co/about-us>.

⁶⁴ UNCTAD, 2023, *Trade and Environment Review 2023: Building a Sustainable and Resilient Ocean Economy Beyond 2030* (United Nations publication, Geneva), <https://unctad.org/publication/trade-and-environment-review-2023>.

⁶⁵ Ibid.

⁶⁶ Samudra, <https://www.samudraoceans.com>.

⁶⁷ Ibid.

Safi Organics aims to alleviate poverty among Kenyan rural farmers by decentralizing fertilizer production, through turning farmers' agricultural waste into high-yield organic fertilizers. Centrally produced and imported traditional fertilizers result in high costs for farmers in developing nations. Safi Organics' technology allows village-level production using local resources and labour, reducing costs while improving their yields. Its fertilizers also contribute to carbon capture and significantly reduce crop residue burning emissions.⁶⁸ To develop its products, the company collaborated with local farmer cooperatives, the Kenyan Organic Research Organization, biochar specialists and academic institutions such as the Massachusetts Institute of Technology.⁶⁹

Boosting an enabling entrepreneurial environment in the circular economy

While there is an undeniable upswing in global circular initiatives, multiple factors still limit entrepreneurial innovations and the advance of a circular economy in developing nations.⁷⁰ Entrepreneurs often struggle with limited access to finance and technologies, which, coupled with the generalized lack of understanding about the circular economy, constrains entrepreneurial circular innovations. Designing clear standards and incentives to guide businesses and entrepreneurial efforts towards circular practices presents its own set of challenges, as well as their implementation.

Collaboration among diverse stakeholders, including public and private sectors and academia, to ensure different areas of expertise can help identify present and future challenges of a successful circular economy transition. This collaboration is also essential to ensure coherence and complementarity across policies. Governments play a crucial role in this process, facilitating coordination and collaboration between agencies, promoting knowledge-exchange platforms and building consensus and commitment across industries towards a shared goal. Box 5 presents examples of such initiatives.

Box 5. Collaboration frameworks toward a circular economy

Thailand's Ministry of Energy has played a pivotal role in encouraging biogas production in the country through a set of coordinated policies within a network of relevant actors. Important stakeholders have included the Ministry of Science and Technology supporting biogas R&D, the Board of Investment with tax incentives to attract private investors, and public research centres and universities, establishing training programmes to strengthen the domestic biogas market.⁷¹

The Connect the Dots initiative, launched by São Paulo's local government in Brazil, aims at supporting local farmers to transit to circular agricultural practices by fostering collaboration and synergies along the value chain. By facilitating coordination between stakeholders, the initiative enables the understanding of production, distribution and consumption processes and allows the municipality to identify challenges and adopt policies for a productive and regenerative agriculture value chain. In addition, it provides local farmers with technical assistance, training and equipment and helps them access financial support. Furthermore, the municipal initiative promotes the transition of farmers to use regenerative techniques by buying their produces at a 30 per cent premium over market price. In 2020, around 40 per cent of the 160 farmers who were part of the initiative had fully switched from conventional to organic or regenerative farming techniques.^{72,73}

⁶⁸ Safi Organics, Award winning organic fertilizer in Kenya, <https://safiorganics.co.ke/about-us/>.

⁶⁹ The Finnish Innovation Fund Sitra, 2020, Decentralized, customizable and resilient fertilizer for farmers in the developing world, <https://www.sitra.fi/en/cases/decentralised-customisable-and-resilient-fertiliser-for-farmers-in-the-developing-world/>, 24 September.

⁷⁰ S Langsdorf and L Duin, 2022, *The Circular Economy and its Impact on Developing and Emerging Countries: An Explorative Study* (Ecologic Institute, Berlin), <https://www.ecologic.eu/18561>.

⁷¹ K Suwanasri, S Trakulvichean, U Grudloyma and M Tanticharoen, 2015, Biogas – Key success factors for promotion in Thailand, *Journal of Sustainable Energy and Environment*, https://www.researchgate.net/publication/281831678_Biogas_-_Key_Success_Factors_for_Promotion_in_Thailand.

⁷² Ellen MacArthur Foundation, Regenerative Agriculture around São Paulo: Connect the Dots, <https://ellenmacarthurfoundation.org/circular-examples/connect-the-dots>.

⁷³ Prefeitura de São Paulo, Applied Research and Advisory Body, Municipal Secretariat of Urban Development of São Paulo, 2016, Connect the Dots, <https://iabr.nl/media/document/original/connectthedots.pdf>.

The African Circular Economy Network (ACEN) was established with the vision to build a restorative and inclusive circular economy in Africa through research, training, awareness-raising and knowledge-sharing initiatives. It explores regional issues in collaboration with local and international researchers. ACEN emphasizes raising awareness and providing training in the circular economy to public and private players. It also promotes collaboration and knowledge sharing, and hosts events for stakeholders to exchange ideas and best practices, with the participation of organizations such as the Ellen MacArthur Foundation, World Economic Forum, and Green Alliance.⁷⁴

In 2021, the Chilean government engaged with key stakeholders to draft the Roadmap for a Circular Chile by 2040, with the aim of designing a long-term strategy to facilitate the transition towards the circular economy. The Roadmap is a long-term vision aiming to build a regenerative, fair and participatory economy. It has assembled more than 100 stakeholders from the public and private sector, NGOs, academia and citizens and is built upon the central idea of collaboration to align all sectors of the economy towards common goals. The development of the Roadmap included a status assessment of the circular economy in the country, consultation processes with major international organizations and experts to set strategic goals and initiatives, regional workshops, thematic round tables, and a public consultation to raise awareness and enable the participation of citizens.⁷⁵

Through a United Nations global initiative towards post-Covid-19 resurgence of the MSMEs sector involving numerous actors, including UNCTAD,⁷⁶ capacity-building tools for governments and MSMEs were developed and implemented to mitigate the economic and social impact of the crisis and facilitate MSMEs' contribution to the implementation of the SDGs. Guidelines and best practices were produced for MSMEs to assure resiliency and progress towards a circular economy, including through the organization of regional webinars and workshops, and the preparation of a compendium (toolbox) of guidance materials addressed to policymakers, entrepreneurs, regulators and other stakeholders. Workshops⁷⁷ and technical webinars were organized for entrepreneurs and business owners on circular business models and opportunities that could be harnessed in different economic sectors.

Standardization of circular principles

Setting up a regulatory environment to promote circular activities can be a challenge in many countries. Without proper oversight and establishment of clear standards and regulations, even well-intentioned circular activities can exacerbate environmental challenges and social inequalities. In India, for example, the processing of over 95 per cent of the e-waste occurs in urban slums, where untrained workers lack sufficient protective gear and risk exposure to a variety of toxins.⁷⁸

Beyond these contexts, while innovative activities in new industries often evolve faster in low regulation environments, a lack of regulation can also hinder the development of circular practices. For instance, in the plastic recycling industry the absence of well-defined waste legislation and standards often results in plastic waste being mixed with other waste, which makes it more difficult and expensive to recover and recycle.⁷⁹ In the case of the textile sector, the introduction of a disposal fee and a better coordination between stakeholders in the material value chain could create incentives to the repair and reuse of clothes.⁸⁰

By properly strengthening circular activities and combining these with standards and regulations, including in the area of environmental, health and sanitation issues, there is room

⁷⁴ ACEN, <https://www.acen.africa/>.

⁷⁵ Ellen MacArthur Foundation, 2022, Chile's Circular Economy Roadmap: Collaboration for a Shared Action Plan, <https://ellenmacarthurfoundation.org/circular-examples/chiles-circular-economy-roadmap>.

⁷⁶ UNCTAD, Global Initiative towards post-Covid-19 resurgence of the MSME sector, <https://msme-resurgence.unctad.org/page/about>.

⁷⁷ Based on UNCTAD Empretec methodology and delivered to entrepreneurs in selected countries in collaboration with established Empretec centres and certified Empretec trainers.

⁷⁸ L Wellesley, F Preston and J Lehne, 2019, An Inclusive Circular Economy: Priorities for Developing Countries (Chatham House), <https://www.chathamhouse.org/2019/05/inclusive-circular-economy/2-challenges-scaling-circular-economy-developing-countries>.

⁷⁹ Technopolis Group, 2016, Regulatory Barriers for the Circular Economy: Lessons from Ten Case Studies, Final report, <https://www.technopolis-group.com/wp-content/uploads/2020/02/Regulatory-barriers-for-the-circular-economy.pdf>.

⁸⁰ H Pacini, 2021, Seizing the opportunities of a circular economy in textiles (UNCTAD), <https://unctad.org/news/seizing-opportunities-circular-economy-textiles>, 28 June.

to create economic opportunities for entrepreneurs to innovate, advance circularity and scale.^{81, 82} A sustainable and inclusive transition to a circular economy requires a clear understanding of the challenges and needs per sector. It will also benefit from collaborative approaches that engage all stakeholders along the whole product life cycle, from design thinking to waste management and recycling.

Regulatory bodies are often well positioned to appoint a facilitator who can lead the process in a collaborative manner. For example, the National Smart Regulation Programme of the Netherlands managed to remove more than 80 barriers to operating a business in the circular fashion. This occurred following a response from entrepreneurs who felt constrained by regulations to run innovative projects. Since then, the government has reinforced the collaboration with entrepreneurs to identify and remove barriers to innovation.⁸³ At the same time, regulations need to be easily accessible, include a clear long-term vision that helps entrepreneurs project themselves in the future and, consequently, allow them to invest in innovative circular business models.

Facilitating the diffusion of technologies and innovation

The leverage of new technologies and innovations are central pillars to entrepreneurs building circular business models.

This is particularly important within the context of navigating circular supply chains, where business models must incorporate ways to efficiently reintroduce the waste generated from one production cycle as inputs for subsequent ones. Achieving this requires industrial symbiosis, higher coordination and planning among suppliers, and the integration of sound supply chain information systems. This integration, in turn, is facilitated with the utilization of ICTs along with other frontier technologies.

The influence of industry 4.0 technologies in circular business models is visible, for example, in the improved sustainability of the organizations. IoT is improving the efficiency in the remanufacturing process,⁸⁴ while AI and machine learning can leverage on real-time data to upgrade connectivity across the supply chain. Similarly, blockchain is improving product traceability and simplifies coordination among suppliers.⁸⁵

To facilitate technological diffusion, especially among start-ups and SMEs, a sound regulatory environment is required that supports the accessibility and affordability of ICT and new technologies. Businesses need to acquire the necessary skills to harness the economic benefits of these emerging technologies. For this, it is essential to craft measures tailored to entrepreneurs and SMEs in digital literacy and technological skills.⁸⁶

Scaling up public investment in R&D projects can further fuel the integration of innovative circular methods and technologies in value chains. Just as digital technologies can improve efficiency and coordination to facilitate the functioning of circular supply chains, R&D can spur innovation in technologies that promote cleaner industrial processes and creative methods to effectively utilize renewable resources.

This can be supported by promoting the establishment of technology development centres and clusters, as well as by reinforcing strategic connections and synergies between technological

⁸¹ UNCTAD, 2018, Circular Economy: The New Normal? UNCTAD Policy Brief No. 61.

⁸² Technopolis Group, 2016, Regulatory Barriers for the Circular Economy: Lessons from Ten Case Studies, Final report, <https://www.technopolis-group.com/wp-content/uploads/2020/02/Regulatory-barriers-for-the-circular-economy.pdf>.

⁸³ Netherlands, Ministry of Infrastructure and the Environment, and Ministry of Economic Affairs, 2016, A Circular Economy in the Netherlands by 2050: Government-wide Programme for a Circular Economy.

⁸⁴ ELS Teixeira, B Tjahjono, M Beltran and J Julião, 2022, Demystifying the digital transition of remanufacturing: A systematic review of literature, *Computers in Industry*, 134:103567, <https://doi.org/10.1016/j.compind.2021.103567>.

⁸⁵ V Gaur, 2020, Building a transparent supply chain, *Harvard Business Review*, May/June, <https://hbr.org/2020/05/building-a-transparent-supply-chain>.

⁸⁶ UNCTAD, 2012, *Entrepreneurship Policy Framework and Implementation Guidance* (United Nations publication, Geneva), https://unctad.org/system/files/official-document/diaeed2012d1_en.pdf.

sectors and applied research in the circular transition.⁸⁷ Good examples of strengthening support programmes in R&D are the CRADLE Programme in the Philippines and the Circusol project of the European Commission, as mentioned in box 6. Also, encouraging technology parks and industrial clusters, such as the Innovation Park Muscat in Oman (see box 6), can enable the exchange of ideas between entrepreneurs, scientists and businesses, which, through cooperation and knowledge-sharing, can support the advancement and integration of innovative technologies for a circular transition.⁸⁸

Box 6. Promoting R&D for the integration of circular technologies

In the Philippines, the CRADLE Programme was established by the Ministry of Science and Technology to foster growth in the national innovation ecosystem around priority areas including renewable energy, industrial waste treatment, environment protection and climate change. The programme encourages R&D by enabling collaboration between academia, R&D institutes and Filipino companies, facilitating the diffusion of new technologies from research environments to industry players.⁸⁹

Circusol is an innovation project funded by the European Commission that aims to address the growing demand for raw materials and tackle the disposal of waste from the solar photovoltaic (PV) and electric vehicle (EV) technologies, such as panels and batteries. Research centres, universities and industrial players from the PV and EV chains collaborate to ensure that the energy transition is achieved with sustainable materials. To achieve this, it focuses on exploring the product–service systems as a business model for a circular solar power industry. In this model, the supplier oversees the product's functionality and end of life, and when the product becomes unsuitable for its original location it can be recovered for reuse or recycling. This encourages product designers to concentrate on durability, reuse, repair, refurbishment and remanufacturing.⁹⁰

The Innovation Park Muscat is an Omani initiative under the Ministry of Higher Education, Research and Innovation aiming at boosting the country's entrepreneurial ecosystem through research and innovation. The Park focuses on boosting the growth of innovative companies in key sectors such as renewable energy, food and biotechnology, water and environment, and health. The initiative functions around state-of-the-art facilities, located near knowledge and industrial hubs that are designed to promote a conducive environment for research and innovation, fostering cooperations between academia, the private sector and different industry sectors.⁹¹

Financing circular innovations

Access to finance can be a major hurdle for entrepreneurs looking to launch innovative projects. While business models in the circular economy can be viable in the long run, for entrepreneurs and SMEs with a limited borrowing history and smaller organizational size, securing funding at affordable rates is often a challenge.⁹² Since circular innovations are new in most sectors, with little to no success history, financial constraints are further heightened.

Unlocking financing opportunities in the circular economy requires the mobilization of capital towards investments that prioritize environmental sustainability. For investors, this involves incorporating environmental, social and governance (ESG) considerations into investment decisions. Governments and regulatory bodies can play an important role in facilitating circular investments in the private sector by providing facilities and levelling the playing field. Emerging sustainable finance taxonomies and definitions, for example, can help investors identify and

⁸⁷ J Zhan and M Meloni, 2021, Born Green via Digital: Increasing MSME's Competitiveness and Sustainability: A Facilitator's Reflection on the G20 Policy Toolkit (UNCTAD).

⁸⁸ United Nations Economic Commission for Europe, 2022, Accelerating the Circular Economy Transition: Policy Options for Harnessing the Power of Trade and Economic Cooperation, UNECE policy brief, Circular Economy Series.

⁸⁹ CRADLE, <https://s4cp.dost.gov.ph/programs/cradle/>.

⁹⁰ Circusol, <https://www.circusol.eu/en/overview/about-circusol>.

⁹¹ Oman, Ministry of Higher Education, Research and Innovation, Innovation Park Muscat, <https://www.trc.gov.om/trcweb/node/36>.

⁹² M Bengtsson and P Schröder, 2021, Building Back Better in ASEAN Countries: Opportunities to Advance a Circular Economy (Hanns Seidel Foundation), <https://southeastasia.hss.de/publications/building-back-better-in-asean-countries-opportunities-to-advance-a-circular-economy-pub2194/>.

compare environmentally sustainable economic opportunities by refining definitions and metrics for circular activities.⁹³ Such efforts can support the establishment of a comprehensive framework for the private sector to target sustainability objectives, which can have important repercussions for funding circular initiatives of SMEs and entrepreneurs. Financial de-risking instruments such as loan guarantees and public–equity or public–private blended finance can further help in transferring to public actors some of the risks that investors face.⁹⁴ This, in turn, can support the funding of circular economy infrastructure and innovative projects that may be more challenging to finance.

The increase of circular projects among entrepreneurs can be supported by leveraging public funding to ensure that circular initiatives find the necessary resources to scale up. This can include facilitating small-scale circular entrepreneurs with special loans, grants, public credit guarantees and “green” funds, as examples in box 7 illustrate. Promoting the role of financial intermediaries such as venture capital and business angels through risk mitigation and incentives schemes can also be beneficial.⁹⁵

A favourable financial ecosystem that supports financing the circular transition ultimately requires close collaboration between the government, regulators and financial institutions. Gaps that limit the financing of circular initiatives need to be identified, along with the development of targeted policies and financial products. Programmes such as the Malaysian Sustainable Finance Initiative can support the building of a sustainable finance ecosystem by bringing together various stakeholder groups within the finance industry, offering a set of guidelines and frameworks as well as incentives to transition to sustainable finance (see box 7).

Box 7. Promoting funding for circular innovation

Grants and other non-reimbursable funds offer an opportunity to create a level playing field for innovative entrepreneurs, SMEs and start-ups in accessing funding. For instance, the Innovate Peru initiative that is led by the Ministry of Finance under the National Competitive and Productivity Plan (NPCP) aims to promote innovation projects, business development, entrepreneurship and ecosystem institutions through national competitions. The types of instruments that the NPCP makes available include non-reimbursable resources to finance eligible project expenses, and co-financing contributions, which can be either monetary or non-monetary.⁹⁶ Other measures to support scaling up circular economy projects include the launch of the Innovation, Technological Modernization, and Entrepreneurship Programme by the Ministry of Production in 2022. This programme, supported by the Inter-American Development Bank, provides assistance to selected MSMEs with financial guarantees to facilitate scaling up innovation projects.⁹⁷ These initiatives collectively strive to foster a conducive environment for innovation and sustainable business development in Peru.

InnovFin – European Union Finance for Innovators – was launched by the European Investment Bank Group and the European Commission in 2014 with the aim of facilitating access to finance for innovative businesses in Europe. The initiative supports projects that are riskier and harder to assess by providing loans, guarantees and equity-type funding tailored to the innovators’ needs.⁹⁸ It also relies on support from “thematic investment platforms”, such as the European Circular Bioeconomy Fund (ECBF), to fill financing gaps in circular-specific projects.⁹⁹ The ECBF specifically focuses on investing

⁹³ European Commission, EU taxonomy for sustainable activities, https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en.

⁹⁴ P Schröder and J Raes, 2021, Financing an Inclusive Circular Economy: De-risking Investments for Circular Business Models and the SDGs (Chatham House), <https://www.chathamhouse.org/2021/07/financing-inclusive-circular-economy>.

⁹⁵ European Commission, Internal Market, Industry, Entrepreneurship and SMEs, https://single-market-economy.ec.europa.eu/access-finance/policy-areas_en.

⁹⁶ Peru, Programa Nacional de Desarrollo Tecnológico e Innovación – ProInnovate, <https://www.proinnovate.gob.pe/>.

⁹⁷ Inter-American Development Bank, 2021, Peru to boost productivity, innovation of small businesses with \$300 million IDB credit, <https://www.iadb.org/en/news/peru-boost-productivity-innovation-small-businesses-300-million-idb-credit>, 24 June.

⁹⁸ European Investment Bank, InnovFin EU Finance for innovators, <https://www.eib.org/en/products/mandates-partnerships/innovfin/index.htm>.

⁹⁹ European Investment Bank, InnovFin Thematic Investment Platforms, <https://www.eib.org/en/products/mandates-partnerships/innovfin/products/thematic-investment-platforms.htm>.

in different industry sectors to support bio-based products derived from renewable resources, such as food, forestry, the blue economy, industrial biotech, packaging, construction, textiles and more.¹⁰⁰

The Malaysian Sustainable Finance Initiative is a programme launched by Capital Markets Malaysia that aims to facilitate the adoption of sustainable financing within the Malaysian financial sector. The initiative brings together representatives from various stakeholder groups within the finance industry involved in green or sustainable project finance, promoting capacity-building, skill enhancement, awareness, and leadership in sustainable finance. It also sets forward a set of guidelines and frameworks, alongside a range of incentives to build a sustainable finance ecosystem. These incentives include a bond grant scheme, tax benefits and a low carbon transition facility designed to support SMEs in implementing sustainable practices.¹⁰¹

Nurturing circular ecosystems

Entrepreneurs in the circular economy face a number of challenges and opportunities for success that are closely linked to their operating environment. Many players in the economy might not see circular products as favourable alternatives to traditional, resource-intensive options. For instance, SMEs and start-ups that run sharing business models in developing countries often need to deal with customers' preference for ownership and trust issues. A shift in mindset is essential to encourage consumers to repair or share products rather than buying new ones. Similarly, businesses may be unaware of opportunities or lack the skills and tools to adopt circular methods. Investors might also need more information on circular activities and the expertise to capitalize on growth opportunities in this area.

For circular innovations to truly achieve scalability, the establishment of mutually reinforcing circular ecosystems is vital. In these ecosystems, consumers, businesses and other stakeholders acknowledge the need to move away from the current linear model and actively demand circular products and services. Such a transition requires significant education and awareness-raising efforts to nurture circular mindsets and facilitate the uptake of circular practices.

Governments can facilitate this change by offering comprehensive awareness programmes, incentives and access to essential infrastructure and technology. For instance, policymakers can stimulate recycling by investing in suitable facilities, designing incentives schemes to recycle, and developing awareness programmes underscoring the methods and importance of reusing, remanufacturing and recycling.¹⁰²

In parallel, businesses across the value chain need to be equipped with the right skills and tools to adapt to new processes and take advantage of circular economy opportunities. Important measures that can be taken are the development of policies that reinforce innovation in the education curriculum, and building and upgrading capacities and know-how for introducing circular methods and technologies.

In some countries, initiatives have led to the creation of collaborative platforms, networks and knowledge-exchange communities to increase information and capacity-building for entrepreneurs and SMEs in the circular economy. Such initiatives, for example the Restart Project in the United Kingdom (see box 8), support the pool of expertise on how to transition to circular practices and offer interesting possibilities of mutual learning. Similarly, incubator and accelerator programmes such as the one offered by PROCOMER in Costa Rica can support small businesses and start-ups to scale circular initiatives by providing technical assistance and mentoring, promoting strategic connections and facilitating access to finance (box 8).

¹⁰⁰ ECBF, <https://www.ecbf.vcl/>.

¹⁰¹ Malaysian Sustainable Finance Initiative, <https://www.msfi.com.my/>.

¹⁰² UNCTAD, 2023, *Technology and Innovation Report 2023 – Opening Green Windows: Technological Opportunities for a Low-carbon World* (United Nations publication, Sales No. E.22.II.D.53, New York and Geneva).


Box 8. Collaboration and knowledge exchange

The Restart Project is a British community-based start-up set up in 2013 aiming to promote the repair and reuse of electronic products. It organizes regular events called Restart Parties where participants teach other peers how to repair broken or faulty electronic devices.¹⁰³ The Restart Project uses data-collection systems in the repair events to continuously increase the learning process on how to refurbish products more effectively. Furthermore, the use of data enables participants to assess their positive impact on the environment, allowing for the promotion of more repairable products and pro-repair policies.¹⁰⁴

PROCOMER, the Export Promotion Agency of Costa Rica, supports green tech start-ups in scaling up through the Pomona GreenTech incubation programme. The programme primarily targets start-ups that develop environmentally friendly technological solutions, harness alternative energy sources and show highly innovative business models. By offering specialized mentoring services and access to a large network of contacts, including other start-ups and investors, the initiative strengthens entrepreneurial skills and accelerates their expansion to international markets.¹⁰⁵

Policy options

The overview presented below outlines a series of policy options aimed at fostering an entrepreneurial ecosystem conducive to the advancement of the circular economy. Based on UNCTAD *Entrepreneurship Policy Framework and Implementation Guidance*,¹⁰⁶ it identifies five key pillars, each accompanied by corresponding policies, that can provide the momentum required to scale up circular business models, foster innovation and nurture the widespread adoption of circular practices. While recognizing that “one size does not fit all” and acknowledging that, because of their complexity and cost, some of the policy options are feasible only in more developed economies, the proposed outline serves as a menu of policy options that can help policymakers to begin the strategy formulation process to boost circular entrepreneurship.



Pillar	Policy objective	Policy options
<p>Adapting the regulatory environment in support of circular entrepreneurship</p> 	<p>1. Promote the creation of circular business models by setting technical standards and specifications of circular activities</p>	<ul style="list-style-type: none"> ✓ Introduce the application of extended producer responsibility (EPR) to a wide range of products to ensure the responsible management and recycling of products at the end of their life cycle. ✓ Facilitate the reverse logistics of collecting and returning products and materials at the end of their useful life by setting sector-specific standards and requirements of recycling and reuse. ✓ Develop circular guidelines in collaboration with the private sector focused on improving durability, adaptability and resource efficiency of products. For example, in the construction sector, establish guidelines for designing building materials that prioritize durability and disassembly to facilitate the circularity of materials.



¹⁰³ The Restart Project, <https://therestartproject.org/about/>.

¹⁰⁴ The Restart Project, The Fixometer, <https://therestartproject.org/fixometer-2/>.

¹⁰⁵ Pomona, <https://pomonaagreentechcostarica.com/>.

¹⁰⁶ UNCTAD, 2012, *Entrepreneurship Policy Framework and Implementation Guidance* (United Nations publication, New York and Geneva), https://unctad.org/system/files/official-document/diaeed2012d1_en.pdf.

		<ul style="list-style-type: none"> ✓ Increase the transparency of circular activities by introducing certification schemes of products designed and produced following circular principles.
	2. Encourage circular activities through incentives	<ul style="list-style-type: none"> ✓ Utilize differentiated VAT rates to encourage circular practices (e.g., lower rates for repair services and circular business models). ✓ Introduce taxes on resource intensive products and activities with adverse environmental impacts (e.g., consider implementing taxes on landfill and incineration to incentivize reduced waste generation). ✓ Implement excise duties on single-use plastics and higher tax rates for non-circular products to disincentivize wasteful consumption.
<p>Enhancing circular entrepreneurship education and skill development</p> 	1. Build and upgrade capacities and know-how for introducing circular methods	<ul style="list-style-type: none"> ✓ Support knowledge exchange platforms to facilitate information sharing and build the capacity of SMEs and start-ups in adopting circular principles. ✓ Promote educational programmes and vocational training to entrepreneurs to enhance the understanding of circular design principles.
	2. Partner with the private sector	<ul style="list-style-type: none"> ✓ Collaborate with private-sector stakeholders to identify priority areas in circular skill development. ✓ Encourage private-sector sponsorship for circular entrepreneurship training and skill development in the circular economy. ✓ Support private-sector involvement through mentoring programmes at various educational levels to nurture circular entrepreneurship.
<p>Facilitating the diffusion of technologies and innovation for a circular economy</p> 	1. Promote inter-firm networks to facilitate the diffusion of technologies and innovation in the circular economy	<ul style="list-style-type: none"> ✓ Encourage horizontal linkages and introduce circular principles in cluster development. ✓ Support vertical linkages and collaboration along the supply value chain to promote circular innovation.
	2. Promote R&D activities aimed at spurring entrepreneurial innovation	<ul style="list-style-type: none"> ✓ Establish collaborative efforts between public bodies, research institutions, universities and the private sector. Identify joint research activities, promote public–private partnerships (PPPs), and create mixed public–private structures to drive innovation for the circular economy.
	3. Support high-tech start-ups offering strategic circular solutions	<ul style="list-style-type: none"> ✓ Establish business incubators, knowledge hubs and science parks dedicated to the circular economy. ✓ Build networks with leading science experts and academics to foster innovation and growth in the circular technology sector.

<p>Improving access to finance for circular business models</p> 	1. Make available public support to facilitate access to finance for promising circular economy schemes	<ul style="list-style-type: none"> ✓ Establish a public fund and public credit guarantee schemes dedicated to circular entrepreneurs and start-ups to facilitate access to seed capital. ✓ Promote PPPs, blended finance and other de-risking instruments.
	2. Promote funding for circular innovation	<ul style="list-style-type: none"> ✓ Offer government subsidies or grants to support R&D activities related to the circular economy. ✓ Provide incentives to attract venture capital investors and business angels. ✓ Encourage equity and “risk capital” financing modalities.
	3. Promote investment transparency in circular opportunities	<ul style="list-style-type: none"> ✓ Standardize definitions and metrics to measure and report on circular ventures.
<p>Promoting awareness and networking in favour of circular entrepreneurship</p> 	1. Raise awareness about circular entrepreneurship	<ul style="list-style-type: none"> ✓ Promote circular products, services, processes and business models through communication campaigns, educational curricula and others.
	2. Foster networking and collaboration among industry players and entrepreneurs in the circular economy	<ul style="list-style-type: none"> ✓ Organize fairs, develop collaborative networks of circular entrepreneurship and circular entrepreneurship associations.

Key takeaways

The circular economy is a growing economic model that not only tackles pressing environmental challenges but also has the potential to unlock economic growth and job creation, and contribute to building resilient and sustainable societies.

Entrepreneurs are catalysers of the circular economy, acting as agents of change through experimentation and creativity. Armed with innovative solutions tailored to local challenges, entrepreneurs driving SMEs and start-ups have the power to bring about mindset changes within their communities and send ripples of change throughout the entire value chain.

Despite the vast array of economic and social opportunities that the circular economy offers, its implementation encounters challenges that hold back entrepreneurial innovation, especially in developing countries.

To develop the circular economy and help SMEs and start-ups scale in this new model, the following considerations are important:

- (a) **Multi-stakeholder collaboration is key:** A collaborative approach of public- and private-sector players on ways forward is needed to effectively transition to the circular economy. Bottlenecks, challenges and opportunities need to be identified per industry, along with associated policy tools such as regulations, standards and schemes to encourage entrepreneurs to innovate and adapt their business models. This collaboration is also essential to ensure coherence and complementarity across policies. Regulatory bodies are often well positioned to appoint a facilitator who can lead the process in a collaborative manner.
- (b) **Capital needs to be mobilized to scale the circular economy:** To de-risk investments and stimulate circular innovation and entrepreneurship, there is a need for public support. Increased public and private investment in these areas can be mutually beneficial, enabling

the alignment with ESG goals while seizing opportunities for sustainable growth. Public institutions play an important role in driving this shift. They can spearhead change by directly investing in key economic sectors, facilitating special loans at favourable rates, offering grants, supporting R&D initiatives, and aligning taxes and subsidies to promote circular initiatives.

- (c) **Embracing the circular economy requires a mindset change:** Boosting innovation and entrepreneurship in the circular economy requires significant education and awareness-raising efforts to facilitate the uptake of circular practices. A mindset shift towards circularity can be promoted by empowering entrepreneurial initiatives through targeted incentives and support mechanisms. Initiatives such as knowledge exchange platforms to increase information and capacity-building for SMEs and start-ups, as well as incubators and accelerators focused on the circular economy, can provide the necessary resources to entrepreneurs to advance circular innovations.

