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The circular economy in Latin America and the Caribbean

Opportunities for building resilience

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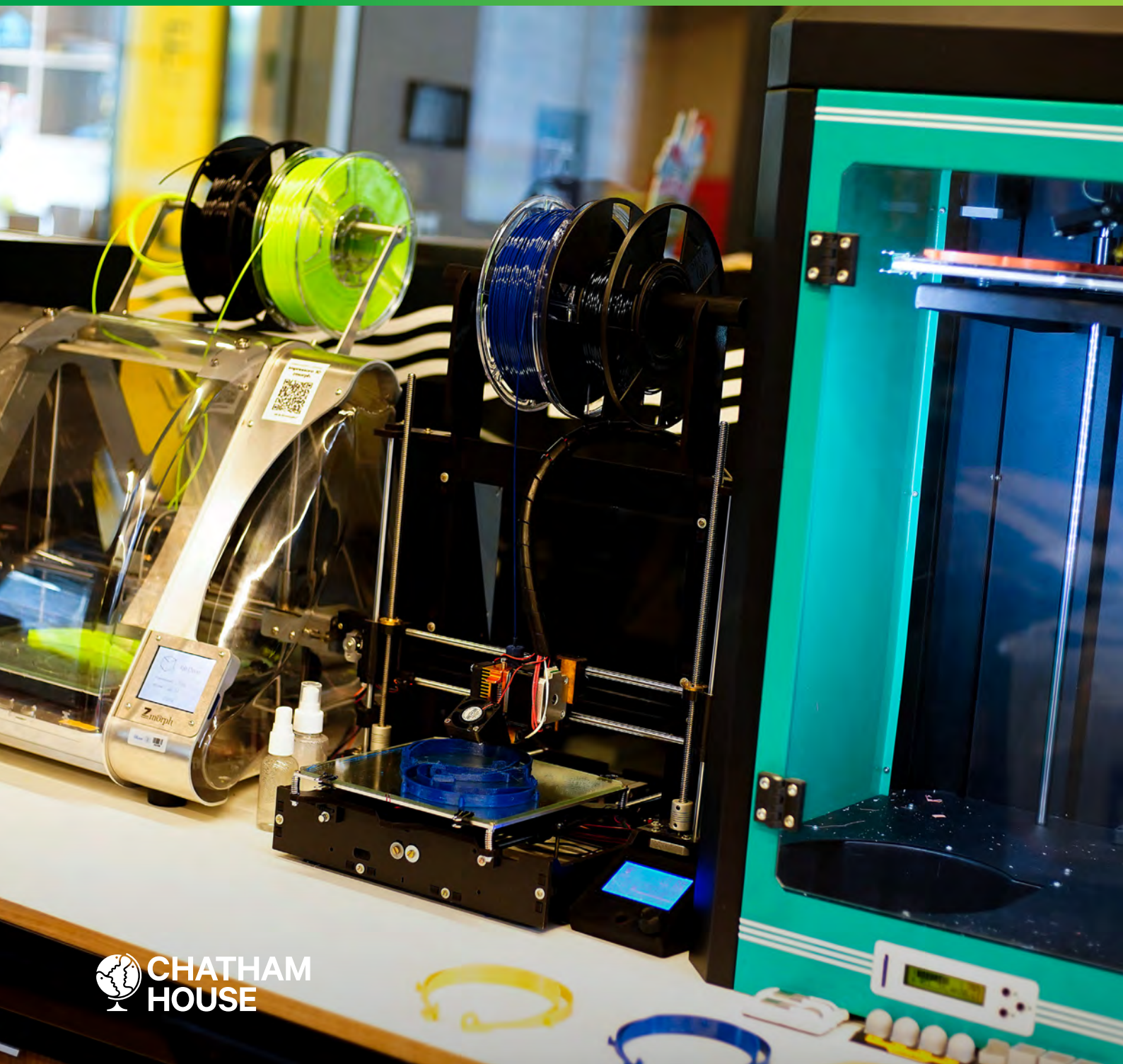

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Contents

Summary

- The circular economy has gained prominence in Latin America and the Caribbean (LAC) in recent years as an approach to sustainable development. Countries in the region have either implemented or are planning new circular economy policies, public initiatives and roadmaps.
- The COVID-19 pandemic has revealed significant shortcomings in the linear economy – the vulnerability of global value chains, the depletion of natural resources and the exacerbation of social inequalities. The circular economy offers an alternative framework for a more resilient and inclusive economic model in LAC countries.
- A successful transition towards the circular economy in LAC will depend on the widespread adoption of Industry 4.0 technologies. Industry 4.0 is a key enabler of the circular economy, allowing new business models to be profitable while reducing environmental impacts. LAC governments need to support a circular economy transition through a technology lens, to guarantee both added value and sustainability.
- LAC countries must invest more in research and development in order to take full advantage of Industry 4.0 technologies and apply them to a circular economy transition. Investment in science and technology is still comparatively low, equating on average to just 0.66 per cent of GDP across the region, with enterprises (public and private) financing only about 36 per cent of that share.
- Social and environmental justice considerations are of equal importance in the circular economy model. A 'just transition' approach is important to ensure that the circular economy does not perpetuate existing inequalities of the linear economic model, or damage livelihoods through new technologies and the automation of jobs. A social innovation-based approach to the circular economy in the LAC region can reduce poverty while promoting human development and sustainable consumption patterns for a more resilient and inclusive society.
- Good governance and the establishment of transparent, rules-based institutions at the national level are crucial for a successful and inclusive circular economy transition in the region. Providing a stable investment environment and functioning markets for business, as well as addressing inequality, are all crucial for success. At the regional level, strategies can be designed to ensure that countries coordinate to support national and subnational regions in the transition.

— The current financing situation for the circular economy in the LAC region is limited mainly to the provision of international development finance for waste management and recycling, which are at the lower end of the valorization hierarchy within the circular economy. Over the next decade there could be substantial changes across the region in waste management, which will need to be financed. It is important to attract both domestic and foreign investments beyond the waste management sector to make the transition to a circular economy possible.

— The three major industrial areas that are a priority for the circular economy in LAC are the mining and extractives sector, waste management and recycling, and the bioeconomy. Circular economy practices in the mining sector are essential for reducing environmental impacts and social risks. They will also improve the sector's competitiveness as demand for primary metals and minerals falls due to urban mining and advances in product reuse, material recovery and recycling technologies. In the waste management and recycling sector, circular economy practices could reduce the amount of waste that is either landfilled or burned. Meanwhile, the bioeconomy offers major opportunities for sustainable food systems and agriculture in the region, which can help avoid trade-offs between economic, social and environmental objectives.

01 Introduction

With heightened urgency around international commitments on the environment and development, the circular economic model offers Latin America and the Caribbean (LAC) an alternative way of upholding the region's global responsibilities.

The emerging momentum of the circular economy in LAC

The circular economy model has gained high-level political attention and support in Latin America and the Caribbean (LAC) in recent years. The region has already launched more than 80 public initiatives relating to the circular economy.[1] These policies are important enablers that are necessary to accelerate and scale up circular practices in the economy, such as changes in product design, in supply chains and industrial production processes, and in how products are being used and disposed of at the end of their lifetime.[2]

In 2019, the circular economy concept gained significant traction at the regional level in LAC. In November of that year, the Intersessional Meeting of the Forum of Ministers of Environment of Latin America and the Caribbean announced proposals for a Regional Coalition on Circular Economy (Coalición Regional de Economía Circular), 'with the main objectives [of developing] a common regional vision and strategy on circular economy in order to have a bigger impact, to build cooperation and exchange best practices', tasking the UN Environment Programme (UNEP) with building the coalition in close cooperation with the United Nations Industrial Development Organization (UNIDO) and other

1 Cerna, L., Aravena, A., Castello, N. and Urrutia, R. (2019), *Economía Circular y Políticas Públicas: Estado del arte y desafíos para la construcción de un marco político de promoción de economía circular en América Latina [Circular Economy and Public Policies: Best practice and challenges for the construction of a political framework to promote the circular economy in Latin America]*, Konrad-Adenauer-Stiftung, https://www.kas.de/es/web/energie-klima-lateinamerika/einzeltitel/-/content/economia-circular-y-politicas-publicas (accessed 16 Jun. 2020).
2 World Business Council for Sustainable Development (2019), *Policy enablers to accelerate the circular economy: Scaling up actions across regions and stakeholders*, Geneva: WBCSD, https://circulareconomy.europa.eu/platform/sites/default/files/wbcsd_policy_enablers_to_accelerate_the_circular_economy.pdf (accessed 16 Jun. 2020).

international and regional partners.[3] In the context of the post-COVID-19 recovery in the region, the circular economy is gaining additional attention as a solution to increase resilience and mitigate future disruptions.[4]

This research paper provides analysis of the current state of circular economy policies in LAC and identifies priority issues for national governments, businesses, civil society and the research community. It has five aims:

- To map circular economy-related policies and public initiatives in LAC;
- To identify opportunities to build resilience in LAC economies and societies through the circular economy, post-COVID-19;
- To analyse challenges and solutions associated with the transition from a linear to a circular economy in the LAC context;
- To highlight the relevance of Industry 4.0 technologies and innovation for the circular economy; and
- To give special consideration to the need for a 'just transition', which figures prominently in the climate change debate, but whose applicability is equally relevant in relation to the circular economy.

The analysis and findings of this paper are based on a literature review and on insights gathered from a Chatham House research workshop – 'Just Circular Economy Transitions in Latin America', held in Montevideo, Uruguay, in December 2019, with 33 participants from eight LAC countries – as well as on the responses to a follow-up survey after the event. The survey was designed to gain insights into how the circular economy is understood in LAC among leading stakeholders including governments, international organizations, academia, civil society and the business community. The survey was completed by 28 stakeholders representing 11 LAC countries (see Annex for details of participants and the full survey methodology) and participants were asked to indicate and elaborate on the sectors they felt would most benefit from a transition to the circular economy and those that would face the greatest challenges, the key policies required to support an inclusive transition, as well as their thoughts on existing financing opportunities and requirements, technological needs and the role of trade. The results from the literature review, workshop and survey ultimately led to this paper focusing on the bioeconomy, waste and extractive sectors as the most likely to be affected by the introduction of the circular economy in LAC. The selection of countries included in the analysis was based on the geographical representation at the workshop and in the survey, as well as on the literature review.

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3 UN Environment Programme (2019), 'Conclusions and recommendations of the Intersessional Meeting of the Forum of Ministers of Environment of Latin America and the Caribbean', UNEP/LAC–IC.2019/8, 6 November 2019, https://wedocs.unep.org/bitstream/handle/20.500.11822/31103/conclusions.pdf?sequence=1&isAllowed=y (accessed 16 Jun. 2020).
4 Kechichian, E. and Mahmoud, N. (2020), 'The circular economy can support COVID-19 response and build resilience', World Bank Blogs, 18 May 2020, https://blogs.worldbank.org/psd/circular-economy-can-support-covid-19-response-and-build-resilience (accessed 16 Jun. 2020).

Just circular economy transitions

The circular economy entails moving away from the current linear economic model of 'take–make–throw away', in which resources are extracted, turned into products, consumed and finally discarded. In a circular world, by contrast, products and materials are kept in circulation for as long as possible by designing them to be more durable, reusable, repairable and recyclable. The circular economy concept applies life cycle thinking and 'cradle to cradle' approaches, considering residues as the 'food' for new products and processes, and is underpinned by the shift to using renewable energy sources.[5]

Transitioning to a circular economy is critical for achieving the targets of the Paris Agreement and the 2030 Agenda for Sustainable Development. Emissions from the production of materials accounted for 15 per cent of global greenhouse gases in 1995, this figure increased to 23 per cent in 2015.[6] Implementing circular economy strategies in five major sectors – steel, cement, plastic, food and aluminium – could reduce global emissions from the production of key materials by 40 per cent, or 3.7 billion tonnes, in 2050.[7]

Transitioning to a circular economy is critical for achieving the targets of the Paris Agreement and the 2030 Agenda for Sustainable Development.

The circular economy is also critical for addressing the global waste crisis, which threatens environments, public health and economic development worldwide. About 40 per cent of plastic waste is not accounted for in managed landfills or recycling facilities, and it is estimated that between 4.8–12.7 million tonnes of such waste enter the oceans each year as marine litter and microplastic particles.[8] Moreover, the transition to a circular economy has the potential to be a driver of job creation, value addition and economic growth, when supported by appropriate policies, legislation and incentives.[9]

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5 Braungart, M., McDonough, W. and Bollinger, A. (2007), 'Cradle-to-cradle design: creating healthy emissions: a strategy for eco-effective product and system design', *Journal of Cleaner Production*, 15 (13–14): pp. 1337–48, doi:10.1016/j.jclepro.2006.08.003 (accessed 16 Jun. 2020).
6 International Resource Panel (2020), *Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future*, Nairobi: UN Environment Programme, https://www.unenvironment.org/resources/report/resource-efficiency-and-climate-change-material-efficiency-strategies-low-carbon (accessed 16 Jun. 2020).
7 Ellen MacArthur Foundation (2019), *Completing the Picture: How the Circular Economy Tackles Climate Change*, https://www.ellenmacarthurfoundation.org/assets/downloads/Completing_The_Picture_How_The_Circular_Economy-_Tackles_Climate_Change_V3_26_September.pdf (accessed 29 Nov. 2019).
8 Worm, B., Lotze, H. K., Jubinville, I., Wilcox, C. and Jambeck, J. (2018), 'Plastic as a Persistent Marine Pollutant', *Annual Review of Environment and Resources*, 42: pp. 1–26, https://www.annualreviews.org/doi/10.1146/annurev-environ-102016-060700 (accessed 16 Jun. 2020).
9 McCarthy, A., Dellink, R. and Bibas, R. (2018), *The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches*, OECD Environment Working Papers, No. 130, Paris: OECD Publishing, p. 12, doi:10.1787af983f9a-en (accessed 23 Nov. 2019); International Labour Organization (2018), *World Employment Social Outlook 2018: Greening with Jobs*, Geneva: ILO, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_628654.pdf (accessed 23 Nov. 2019).

Yet the shift away from the linear economic model may generate losers as well as winners – as detailed in the Chatham House research paper *Promoting a Just Transition to an Inclusive Circular Economy*.[10] Until recently, academic discussions, policy frameworks and business initiatives promoting the circular economy have focused mainly on the European and Chinese contexts.[11] However, this situation is changing rapidly as new research is beginning to analyse how the transitions to circular economies, and their narratives, are taking shape in the Global South.[12] Particularly in the context of these regions, there are important sociopolitical issues to consider. Identifying these, and tailoring policies and international programmes to support those countries and communities that are at risk of being left behind, is critical for ensuring a just transition. Given the high levels of inequality and poverty in the LAC region, this paper argues that the transition to a circular economy needs to be compatible with, and even a promoter of, these social objectives and human development priorities. The emergence of more resilient societies is contingent on addressing the 'triple bottom line' of economic, social and environmental needs.[13]

Box 1. Just transitions and the circular economy

The term and concept 'just transition' brings together concerns about social and environmental justice in the transition to a sustainable economy and society.[14] The concept originates from environmental and climate justice movements that have consistently criticized the linear economic model. Social movements have a long history in the LAC region and are important stakeholders in debates about development and sustainability. Recently, in the context of COP 25, held in Madrid in December 2019, Latin American social movements stated their opposition to the neoliberal extractivist model, and proposed a justice-oriented approach to solving the climate crisis.[15]

The EU introduced a Just Transition Mechanism[16] in early 2020, within the context of the green energy transition and climate change. The Just Transition Mechanism aims to ensure solidarity and fairness, so that climate mitigation actions do not disproportionally affect the vulnerable. In this context, the just transition refers to political processes that support regions, industries, workers and communities adversely impacted by environmental mitigation measures; it recognizes rights to resources; and resolves competing development interests through participatory processes.

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10 Schröder, P. (2020), *Promoting a Just Transition to an Inclusive Circular Economy*, Chatham House Research Paper, London: Royal Institute for International Affairs, https://www.chathamhouse.org/publication/promoting-just-transition-inclusive-circular-economy (accessed 22 Jul. 2020).
11 Preston, F., Lehne, J. and Wellesley, L. (2019), *An Inclusive Circular Economy: Priorities for Developing Countries*, Chatham House Research Paper, London: Royal Institute for International Affairs, p. 5, https://www.chathamhouse.org/sites/default/files/publications/research/2019-05-22-Circular%20Economy.pdf (accessed 20 Nov. 2019).
12 Schröder, P., Anantharaman, M., Anggraeni, K. and Foxon, T. (eds) (2019), *The Circular Economy and the Global South: Sustainable Lifestyles and Green Industrial Development*, Abingdon and New York: Routledge.
13 Schröder, P., Lemille, A. and Desmond, P. (2020), 'Making the circular economy work for human development', *Resources, Conservation and Recycling*, 156, 104686, doi:10.1016/j.resconrec.2020.104686 (accessed 16 Jun. 2020).
14 Heffron, R. and McCauley, D. (2018), 'What is the "Just Transition"?', *Geoforum,* 88: pp. 74–7, https://www.sciencedirect.com/science/article/pii/S0016718517303287 (accessed 16 Jun. 2020).
15 Coalition of Climate Justice Movements (2019), 'COP25, Social Movements and Climate Justice: A declaration on climate crisis, energy transition and extractivism in Latin America', Common Dreams, 2 December 2019, https://www.commondreams.org/views/2019/12/02/cop25-social-movements-and-climate-justice (accessed 16 May 2020).
16 European Commission (2020), *Launching the Just Transition Mechanism – for a green transition based on solidarity and fairness*, press release, 15 January 2020, https://ec.europa.eu/info/news/launching-just-transition-mechanism-green-transition-based-solidarity-and-fairness-2020-jan-15_en (accessed 16 Jun. 2020).

In *Promoting a Just Transition to an Inclusive Circular Economy*,[17] it was argued that justice considerations are equally important for the circular economy transition. While the transition to a circular economy can address several of the most pressing challenges of our time, it will also entail a systemic change to the way our economies work. Although it is likely that there will be a net positive outcome in terms of employment opportunities, many workers, industries and communities could be adversely impacted. Therefore, it is important that circular economy policies and programmes identify and adequately respond to social risks.

In the context of the COVID-19 pandemic, the just transition approach has become even more relevant. If, as estimated by the UN Economic Commission for Latin America and the Caribbean (ECLAC), the pandemic results in an increase of 10 per cent in unemployment in the region, it is anticipated that the number of people classified as poor in the region will increase from 185 million to 220 million.[18] The current lack of adequate social protection and unemployment benefits in the region as a whole must be addressed in order to avoid a social care disaster.

Sustainable Development Goals and the circular economy – priorities in LAC

As is the case for most regions around the world, the countries of LAC will need to renew efforts to meet the targets of the UN Sustainable Development Goals (SDGs). The circular economy concept already fits within the existing SDGs, particularly SDG 12 (sustainable consumption and production).[19] By pushing SDG 12 forward via the implementation of circular economy solutions, progress on other environmental, social and economic SDGs can also be achieved. Examples are SDG 6 (ensure access to water and sanitation for all), SDG 11 (making cities inclusive, safe, resilient and sustainable – for example, by improving housing conditions in informal settlements), as well as SDGs 8 and 9 on sustainable growth and industrialization (promote inclusive and sustainable economic growth, employment and decent work for all; build resilient infrastructure, promote sustainable industrialization and foster innovation).[20]

In 2019, the Argentine Business Council for Sustainable Development (CEADS) surveyed a number of businesses to identify how circular practices could help to achieve Argentina's climate targets and SDGs. The study found that 56 per cent of the businesses surveyed directly contributed to greenhouse gas reductions through using circular practices, and 70 per cent contributed indirectly. However, without an agreed set of metrics on resource intensity of production, reliable

17 Schröder (2020), *Promoting a Just Transition to an Inclusive Circular Economy.*
18 Smith, A. (2020), 'Covid-19 hits an economically weak and deeply unequal Latin America', Open Democracy, 7 May 2020, https://www.opendemocracy.net/en/democraciaabierta/la-covid-19-llega-una-am%C3%A9rica-latina-econ%C3%B3micamente-d%C3%A9bil-y-profundamente-desigual-en/ (accessed 10 Jun. 2020).
19 Schröder, P., Anggraeni, K. and Weber, U. (2018), 'The Relevance of Circular Economy Practices to the Sustainable Development Goals', *Journal of Industrial Ecology*, doi:10.1111/jiec.12732 (accessed 17 Jun. 2020).
20 Nicolai, S., Bhatkal, T., Hoy, C. and Aedy, T. (2016), *Projecting progress: the SDGs in Latin America and the Caribbean*, London: Overseas Development Institute, https://www.odi.org/sites/odi.org.uk/files/resource-documents/10645.pdf (accessed 16 Jun. 2020).

measurements and comparisons over time are not possible. The study pointed to the need for standard indicators for the circular economy to record its impact and make progress towards the SDGs more transparent.[21]

LAC's national economies have been heavily dependent on natural resource exports for the last two decades, with exports increasing significantly during the 2003–13 commodity price surge in particular. Yet, many of the countries have been unable to capitalize on this specialization in natural resource exports. In fact, some LAC countries face negative 'Dutch disease' effects due to dependence on resource commodity exports and macroeconomic vulnerabilities generated by commodity cycles,[22] where countries have not been able to develop appropriate countercyclical macroeconomic policies.[23] In this context, the circular economy offers an opportunity for intrasectoral diversification to generate added value domestically, contributing to SDG 8 (sustainable economic growth and decent work), SDG 9 (sustainable industrialization) and SDG 12 (sustainable consumption and production).

The circular economy offers an opportunity for intrasectoral diversification to generate added value domestically, contributing to SDG 8, SDG 9 and SDG 12.

Only an inclusive circular economy can also support achieving the social SDGs, including SDG 1 (eliminating poverty) and SDG 10 (reducing inequalities). While most countries in the region are classified as upper-middle-income countries,[24] the degree of inequality is generally high, with significant pockets of poverty. In Haiti, which is the only low-income country of the region, approximately 59 per cent of the population is estimated to live below the national poverty line, and the GINI index (the most widely used international measure of inequality) is 41.1. In Guatemala and Mexico, both ranked as upper-middle-income countries, 62 per cent and 42 per cent of the populations, respectively, live in poverty and their GINI indexes are also high, indicating greater inequality than in Haiti, at 48.3 and 45.4, respectively. Although net poverty in Chile has fallen over the last decade, the country has one of the worst rates of inequality in Latin America and the highest GINI index in the OECD (44.4). Chile is now a frontrunner in the development of an institutional framework to support the circular economy. However, the social unrest of 2019 highlighted the fact that, in order for the circular economy to prove successful as a new paradigm for sustainable development, it is necessary to ensure that the model works towards human development objectives, by reducing inequality as well as poverty.

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21 CEADS (2019), 'Economía circular: Análisis de la contribución de medidas de economía circular en empresas a las metas climáticas y la agenda 2030 en Argentina' [Circular economy: Analysis of the contribution of circular economy measures within businesses to the climate goals and 2030 agenda in Argentina], http://www.ceads.org.ar/wp-content/uploads/2020/01/Informe-EC-OK.pdf (accessed 22 Jun. 2020).
22 The Economist (2014), 'What Dutch disease is, and why it's bad', 5 November 2014, https://www.economist.com/the-economist-explains/2014/11/05/what-dutch-disease-is-and-why-its-bad (accessed 17 Jun. 2020).
23 Ocampo, J. (2017), 'Commodity-Led Development in Latin America' in *Alternative Pathways to Sustainable Development: Lessons from Latin America*, *International Development Policy* series No. 9 (Geneva and Boston: Graduate Institute Publications, Brill-Nijhoff), pp. 51–76, doi:10.4000/poldev.2354 (accessed 16 Jun. 2020).
24 World Bank (n.d.), 'World Bank Country and Lending Groups', https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (accessed 16 Jun. 2020).

Box 2. How can the circular economy support the SDGs in LAC?

There are several examples of how the circular economy can support the implementation and achievement of the SDG goals in LAC. Across the region an estimated 113 million people – about one in five – live in slums.[25] Substandard housing in which there is little or no access to running water or health facilities is a common characteristic of the urban landscape and sprawl. Improving living conditions in slum areas and informal settlements is a priority for achieving sustainable cities and inclusive communities (SDG 11). A new technology that could make an impact is 3D printing of low-cost houses, which uses a mix of concrete, water and other materials. A hybrid of concrete mortar that hardens as it is printed produces layers of structures that can be used to build a house for as little as $4,000.[26] Pilot projects using this approach to construct affordable housing are being implemented to help low-income families in El Salvador,[27] who live in tents and temporary shelters, having lost their homes due to earthquakes and other natural disasters. In Mexico, an entirely new neighbourhood is being printed in 3D and made available to 50 families on low incomes, some of whom earn as little as $3 per day.[28]

Circular economy solutions can also help to achieve SDG 6 (secure access to clean water and sanitation). By 2025, all LAC countries – except Costa Rica, Panama, Ecuador, Suriname and Uruguay – are projected to become water scarce, as insufficient infrastructure will mean renewable water sources cannot be accessed to satisfy demand.[29] Recovery of wastewater resources is already under way in several countries (albeit in an ad hoc manner) and needs to be scaled up. One example is the Atotonilco wastewater treatment plant, which contributes to sustainable water use in the Valley of Mexico metropolitan area. A variety of treatment processes are used to obtain value from all by-products: wastewater from the plant is used to irrigate up to 90,000 hectares of agricultural land in the Mezquital Valley, while electricity and thermal energy are produced from sludge, and biosolids are produced for soil enhancement in forests and in agriculture.[30]

25 Lopez, O. and Moloney, A. (2020), 'Coronavirus chases the slum dwellers of Latin America', *National Post,* 18 March 2020, https://nationalpost.com/pmn/health-pmn/coronavirus-chases-the-slum-dwellers-of-latin-america (accessed 16 Jun. 2020).
26 Loughran, J. (2018), '3D-printed concrete houses set to improve life for slum dwellers', Engineering and Technology, 16 March 2018, https://eandt.theiet.org/content/articles/2018/03/3d-printed-concrete-houses-set-to-improve-life-for-slum-dwellers/ (accessed 17 Jul. 2020).
27 The Borgen Project (2018), 'Printing Homes: Affordable Housing for Disaster-Prone Areas', https://borgenproject.org/affordable-housing/ (accessed 17 Jun. 2020).
28 Fleming, S. (2019), 'This start-up is 3D-printing an entire neighbourhood in Mexico', World Economic Forum, 20 December 2019, https://www.weforum.org/agenda/2019/12/3d-printed-homes-neighborhood-tabasco-mexico/(accessed 17 Jun. 2020).
29 Saltiel, G. (2016), 'What does a circular economy of water mean to Latin America? Join the discussion in Stockholm', World Bank Blog, 28 August 2016, https://blogs.worldbank.org/water/what-does-circular-economy-water-mean-latin-america-join-discussion-stockholm (accessed 24 Mar. 2020).
30 World Bank (2018), *Wastewater: From Waste to Resource – The Case of Atotonilco de Tula, Mexico (English)*, Washington, DC: World Bank Group, http://documents1.worldbank.org/curated/en/922441521175520658/pdf/124331-WP-19-6-2018-13-5-41-W.pdf (accessed 24 Mar. 2020).

The circular economy and Industry 4.0 – a new production paradigm

The transition towards the circular economy is closely linked to the concept of the 'fourth industrial revolution'.[31] The technology solutions discussed in the circular economy context include digital technologies such as blockchain applications, 3D printing and automation, cloud computing and big data analytics all of which are often summarized under the umbrella term 'Industry 4.0'.[32] These are considered to be key enablers for circular business models,[33] allowing the use of information flows and analytics to reduce waste and to close material loops through reusing and recycling materials, as well as employing more efficient manufacturing processes and reverse logistics. Below are examples of how Industry 4.0 can act as a catalyst to promote circularity practices:

- In the manufacturing sector, 3D printing can eliminate waste in the design process by minimizing material excess in production through prototyping. It also facilitates easy disassembly for the later reuse or recycling of materials.
- In the construction sector, building information modelling (BIM) can be used to simulate building performance from the inception stage of a project, in order to minimize the use of material and human resources during construction, thus enabling the efficient and functional use of space and recovery of materials that are reusable.
- In order to collect, sort and distribute waste, intelligent waste management systems necessarily rely on sensors, big data analytics and cloud computing.[34] Therefore, information generation and sharing of waste flows, facilitated through Industry 4.0 technologies, is of vital relevance to increase recycling shares over solutions such as landfills and incineration.
- The shift towards servitization requires new 'product-as-a-service' models, such as the provision of mobility services alongside, or instead of, one-off sales of passenger cars.[35] This trend is strongly supported by circular economy advocates as a trigger for more sustainable consumption patterns. It requires fundamental changes in the way businesses and consumers understand and value ownership. This shift can only be understood in a context of interconnectivity between consumers and producers, and between producers and suppliers of materials and services. Selling services, rather than products,

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31 País Circular (2020), 'The circular economy brings together the productive and environmental agendas', translated interview with Manuel Albaladejo, UNIDO Representative for Uruguay, Chile, Argentina and Paraguay, 9 March 2020, Santiago de Chile, https://www.greengrowthknowledge.org/blog/circular-economy-brings-together-productive-and-environmental-agendas.
32 Tseng, M.-L., Chiu, A., Liu, G., Jantaralolica, T. (2020), 'Circular economy enables sustainable consumption and production in multi-level supply chain system', *Resources, Conservation and Recycling*, 154, 104601, doi:10.1016/j.resconrec.2019.104601 (accessed 16 Jun. 2020).
33 Wilts, H., Lah, O. and Galinski, L. (2018), 'The Evolution of Industry 4.0 and its Impact on the Knowledge Base for the Circular Economy?', in Anbumozhi, V. and Kimura, F. (eds) (2018), *Industry 4.0: Empowering ASEAN for the Circular Economy*, Jakarta: ERIA, pp. 106–26, https://pdfs.semanticscholar.org/af8b/b34b2e0a4dcfa57da8d8a3da3c36f0e6ff78.pdf (accessed 16 Jun. 2020).
34 Kerdlap, P., Low, J. and Ramakrishna, S. (2019), 'Zero waste manufacturing: A framework and review of technology, research, and implementation barriers for enabling a circular economy transition in Singapore', *Resources, Conservation and Recycling,* 151, 104438, doi:10.1016/j.resconrec.2019.104438 (accessed 16 Jun. 2020).
35 Aubertin, C. (2019), *From Product to Product-as-a-Service: A new business model shaping the future of industries,* Medium, 2 July 2019, https://medium.com/swlh/from-product-to-product-as-a-service-37baed471cd6 (accessed 16 Jun. 2020).

requires the use of smart sensors, location detection technologies, big data and multilevel customer interaction platforms to analyse information on consumers' preferences and habits.

In the context of the COVID-19 crisis, which will result in a major economic slowdown for the region in 2020 and 2021, and the environmental challenges ahead, Industry 4.0 and the circular economy are at the heart of the productive transformation debate in Latin America. Countries in the region have historically shifted from the primary to the manufacturing sector as their economies have developed, given the risks of commodity price fluctuations and the difficulty of increasing productivity and value addition in the extractive and agriculture sectors. While this shift continues to be important, three current trends need to be taken into account: the commoditization of manufacturing, which has led to prices of manufactured goods reaching historic lows; the growing demand for certain specific minerals and primary goods; and the productivity gap and environmental pressures faced by most Latin American countries.

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With the above trends in mind, Industry 4.0 and the circular economy may downplay intersectoral transformations while putting a stronger focus on how to strengthen intrasectoral dynamics. For instance, the future competitiveness of Chile's mining sector relies on the application of advanced technologies for value addition while reducing the environmental impact of mining activity. The country plans to apply Industry 4.0 and circular economy technologies to become a global supplier of lithium batteries for electric cars, making better use of its mineral resources.[36] In agriculture, traditionally considered a low productivity sector, the application of digital technologies has the potential to increase productivity and yields while reducing inputs of chemical fertilizers, enabling the sector to experience its own revolution, the so-called 'Agriculture 4.0'. The adoption of precision agriculture using, for example, drone technology, climate and crop monitoring and precision farming software has certainly raised the profile of agriculture in some parts of the region. Brazil, for example, has gone from being an importer of agricultural technologies to becoming one of the leaders in research and innovation, developing Agriculture 4.0 technologies and processes.[37]

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36 Shumilova, D. (2019), 'A shift in the production paradigm', UNIDO, 30 September 2019, https://www.unido.org/stories/shift-production-paradigm (accessed 16 Jun. 2020).
37 Brazilian Dutch Chamber of Commerce (2019), 'Agriculture 4.0 will reconcile development with the environment', 25 June 2019, https://www.bradutch.com/2019/06/25/agriculture-4-0-will-reconcile-development-with-the-environment/ (accessed 16 Jun. 2020).

While research on the circular economy is gathering pace in LAC, investment in science and technology is still comparatively low, on average equating to just 0.66 per cent of GDP in the region.[38] Moreover, only 36 per cent of that share is financed by enterprises (public and private), which demonstrates the limited capacity of individual firms to absorb Industry 4.0 technologies. Most countries aiming to have technologically advanced circular economy models linked to Industry 4.0 have research and development (R&D) investment rates exceeding 2 per cent of GDP and a higher level of participation of enterprises in the financing and execution of R&D. Both governments and the private sector in the LAC region must, therefore, invest more in R&D in order to ensure the region is able to take full advantage of Industry 4.0 technologies and apply them to a circular economy transition.

Digital inclusion and employment in the circular economy

Making use of digital innovation will be key to realizing circular economy opportunities. It has been estimated that by 2022, the number of internet-enabled devices in LAC will reach 100 million, growing at an annual rate of over 20 per cent.[39] Chile, Costa Rica, and Brazil are considered the three countries most ready to participate in the Industry 4.0 market and benefit from its opportunities.[40] According to Digital Evolution Index 2017, 'Mexico, Colombia, Brazil and Bolivia are considered "break out" countries that are rapidly evolving to widespread digitally-driven innovation'.[41] However, it is important to note that without appropriate policy, fiscal support and skills development initiatives, Industry 4.0 technologies are likely to be taken up disproportionately by larger companies, leaving small businesses at a disadvantage. Making Industry 4.0 technologies accessible to small businesses, and up skilling workers, is key to ensuring a just transition.

While the digital infrastructure coverage gap in LAC is relatively small, with just 10 per cent of the population living outside the reach of 4G or even 3G networks, the usage gap is much larger, with 57 per cent of the population not using mobile broadband, despite network availability. The biggest barriers to uptake of mobile broadband usage are the lack of relevant local content (including content in Spanish), followed by digital literacy and affordability. Only a small percentage of teachers in the region are trained to teach digital literacy, while the cost of mobile services (measured as a percentage of the income of the poorest 40 per cent of the population in each country) varies between 5 per cent (Uruguay) and 42 per cent (Guatemala).[42]

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38 Red de Indicadores de Ciencia y Tecnología Interamericana e Iberoamericana (2018), El Estado de la Ciencia 2018: Principales Indicadores de Ciencia y Tecnología Iberoamericanos/Interamericanos 2018, [The State of Science 2018: Main Indicators of Ibero-American/Inter-American Science and Technology 2018] http://www.ricyt.org/wp-content/uploads/2018/10/www.ricyt_.org_files_edlc_2018.pdf (accessed 3 Aug. 2020).
39 Méndez, F. (2017), 'What can the Internet of Things do for Latin America?', BBVA, https://www.bbva.com/en/can-internet-things-latin-america/ (accessed 16 Jun. 2020).
40 PérezColón, R., Navajas, S. and Terry, E. (2019), *IoT in LAC 2019: Taking the Pulse of the Internet of Things in Latin America and the Caribbean*', Inter-American Development Bank, https://publications.iadb.org/en/iot-lac-2019-taking-pulse-internet-things-latin-america-and-caribbean (accessed 16 Jun. 2020).
41 Muruzábal, C. (2018), 'For Latin America to thrive in the digital era, it must first teachminds, then the machines', World Economic Forum, https://www.weforum.org/agenda/2018/03/here-s-how-latin-america-can-thrive-in-the-digital-era/ (accessed 16 Jun. 2020).
42 GSMA (2016), *Connected Society: Inclusión digital en América Latina y el Caribe [Connected Society: Digital Inclusion in Latin America and the Caribbean]*, https://www.gsma.com/latinamerica/wp-content/uploads/2016/05/report-digital_inclusion-4-ES.pdf (accessed 18 Jun. 2020).

Successfully navigating the digital transformation is as much about technology and infrastructure policy as it is about social welfare and education policy – ensuring that opportunities are accessible to communities at all socio-economic levels and that they contribute to development objectives. It is crucial that Industry 4.0 technologies be affordable and made available at scale, both by design and through financial policy support; that digital literacy be prioritized in the region; and that national information and communications technology (ICT) development plans include the prioritization of locally relevant content, to enable the skills training and accessibility to technology needed for the circular economy transition.

Differing levels of participation by gender in the use of personal technology, and in employment in the technology sector, are also likely to present an issue in LAC. In terms of mobile internet usage the overall gap is small, with just a 2 per cent difference between men and women at regional level, though this varies widely by country; in Guatemala, for example, there is a 15 per cent difference.[43] The difference is more pronounced overall when we look at employment. Since 2017, the proportion of women in employment has stagnated across the region, with only half of women participating in the labour force compared to 74.4 per cent of men.[44] In 2018, according to ECLAC figures, 77.6 per cent of women were employed in low productivity sectors (agriculture, commerce and services) against 55.4 per cent of men. Sectors with average productivity (manufacturing, construction, transport) account for only 13.8 per cent of employed women but for 35 per cent of employed men.[45] One of the factors contributing to women's study and employment choices across the region is the persistence of gender stereotypes concerning the role of women in families. The adoption of Industry 4.0 technologies could deepen the existing gender gap in the region, as the overall proportion of the population employed in low productivity sectors continues to shrink.

Specifically encouraging female entrepreneurship in technology-driven high-productivity sectors is one way to bridge the employment and salary gap. This pattern is reflected in the type of entrepreneurship generated by women in LAC, with a focus on 'triple bottom line' (social, environmental and financial) impacts. One example from Argentina is Daravi,[46] a female-led enterprise founded in 2016 that creates sustainable products, reusing waste materials and prioritizing the design of products with an extended lifespan, generating job opportunities for the community with a focus on women.

The shift to a circular economy must aim to redefine growth, leaving no one behind. Addressing gender stereotypes, promoting technical training for women and female entrepreneurship will be critical to mitigate unequal impacts of the digital transformation on women and, ultimately, to help achieve the SDGs.[47]

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43 GSMA (2020), *Connected Women: The Mobile Gender Gap Report 2020*, https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2020/05/GSMA-The-Mobile-Gender-Gap-Report-2020.pdf (accessed 18 Jun. 2020).
44 International Labour Organization (2017), 2017 Labour Overview, Latin America and the Caribbean, https://www.ilo.org/wcmsp5/groups/public/---americas/---ro-lima/documents/publication/wcms_618120.pdf (accessed 3 Aug. 2020).
45 ECLAC (2018), 'Distribution of total employed population by productivity level and sex', https://oig.cepal.org/en/indicators/distribution-total-employed-population-productivity-level-and-sex (accessed 17 Jun. 2020).
46 Daravi (n.d.), 'Welcome to Daravi', http://daravifabrica.co/homeen (accessed 17 Jun. 2020).
47 Habtezion, S. (2016), 'Overview of linkages between gender and climate change', New York: UN Development Programme, https://www.undp.org/content/dam/undp/library/gender/Gender%20and%20Environment/UNDP%20Linkages%20Gender%20and%20CC%20Policy%20Brief%201-WEB.pdf (accessed 18 Jun. 2020).

COVID-19 impact and recovery

The COVID-19 health crisis has shaken the foundations of the linear economic model. The dramatic slowdown of global production, which started in China, the site of the first major outbreak of coronavirus in 2020, brings into question the supposed benefits of an economic model governed by global value chains (GVCs). ECLAC estimates that the region's exports to China in 2020 could fall by as much as 10.7 per cent in value terms, exposing the reliance of countries such as Chile, Peru and Brazil on the Chinese market.[48] In addition, the disruption of trade flows, in combination with countries' lack of productive capacities, has caused major havoc in supply chains and in the provision of essential healthcare items such as protective masks and respirators, not only in developing but also in developed countries. GVCs are primarily organized around economic drivers such as specialization, costs, market access and economies of scale that rarely take into account environmental considerations such as carbon footprint and resource usage. In summary, GVCs have failed to take account of the interdependencies binding the environmental, social and economic systems.[49]

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A special report from ECLAC states that efforts to create a new economic model are more important than ever.[50] The COVID-19 outbreak unfolding in the LAC region is likely to precipitate the largest economic and social crisis in decades.[51] On average, GDP is expected to contract by 5.3 per cent in 2020 across Latin America, which will have devasting consequences in terms of job losses and increased poverty and inequality. Issues that existed before the crisis, such as low levels of investment in public services and weak social safety nets, coupled with the vast and particularly vulnerable informal sector, make it even more difficult for LAC governments to find ways of combating the economic effects of the pandemic.[52]

In the context of the COVID-19 pandemic, and the widespread questioning of the existing economic model that the crisis has prompted, the circular economy offers a framework for Latin America to rethink its future. Economic recovery in the

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48 Cuéllar, A., Koop, F., Andreoni, M. and Liévano, A. (2020), 'Coronavirus takes toll on Latin American economies', *Diálogo Chino,* 30 March 2020, https://dialogochino.net/en/trade-investment/34547-coronavirus-takes-toll-on-latin-american-economies/ (accessed 17 Jul. 2020).
49 Seric, A., Görg, H., Mösle, S. and Windisch, M. (2020), 'Managing COVID-19: How the pandemic disrupts global value chains', UNIDO Industrial Analytics Platform, April 2020, https://iap.unido.org/articles/managing-covid-19-how-pandemic-disrupts-global-value-chains (accessed 25 May 2020).
50 CEPAL (2020), 'COVID-19 Pandemic Calls on Us to Build a New Development Model and Strengthen Regional Integration to Confront the Crisis: ECLAC', https://www.cepal.org/en/pressreleases/covid-19-pandemic-calls-us-build-new-development-model-and-strengthen-regional (accessed 18 Aug. 2020).
51 ECLAC (2020), 'Latin America and the Caribbean: Quantifying the Impact of COVID-19 With a View to Reactivation', Second Special Report, ISSUU, https://issuu.com/publicacionescepal/docs/covid-19report2 quantifyingtheimpact (accessed 25 May 2020).
52 Santiago, F. and Larsen, J. (2020), 'What will it take for Latin America's faltering economies to thrive after COVID-19?' *Making It: Industry for Development,* 15 May 2020, https://www.makingitmagazine.net/?p=11122 (accessed 20 May 2020).

post-COVID-19 period will call for an economic model that supports well-being, increases resilience and benefits business, people and the environment by decoupling socio-economic development from resource consumption. The circular economy presents an attractive alternative to the prevailing linear model in the developed world.

Box 3. COVID-19, Industry 4.0 and the circular economy

Different initiatives, for example those using 3D printing technology, have arisen in LAC countries as a response to the COVID-19 pandemic, seeking to provide a solution to a widespread lack of personal protective equipment (PPE). Furthermore, in combination with other emerging manufacturing technologies, systems and new materials, 3D printing is already changing the industrial landscape in radical ways – such as in efforts to reduce waste, through prototyping for easy disassembly and reuse of materials. 3D printing is changing the way that manufacturing activities are organized and the nature of the stakeholders involved. The characteristics of 3D printing align well with circularity principles.[53]

For example, the Technological University of Uruguay (UTEC) has created COINNOVATION, an open innovation platform that aims to support the manufacture of biomedical supplies using 3D printing technology.[54] In the first stage of the COVID-19 crisis it focused on preventing the spread of the disease, designing and producing supplies such as face masks and full-face protective screens. The university sought out and incorporated donations of unused printers, CD players, PC towers and Arduino/Raspberry Pi boards in its design and production process. In the spirit of the circular economy, COINNOVATION intends to develop replaceable components for medical equipment used in the treatment of symptomatic COVID-19 patients.

Similar initiatives emerged in Argentina. For example, the Unidos por Argentina initiative brought together more than 100 young volunteers who used their own 3D printing equipment to produce more than 500 full-face protective medical masks per day, which were donated to health personnel. The initiative made use of donations of printing materials and X-ray plates, which go through a discoloration process and become transparent, to be reused as protective acetate. Imprimiendo Escudos is a similar project, also engaged in the 3D printing and assembly of protective masks, but using polylactide (PLA), a thermoplastic material made from renewable agricultural products such as corn starch or sugar cane. The approximate cost of each mask is $2, and by early April 2020 more than 1,500 masks had been donated to hospitals in Argentina.

53 Despeisse, M., Baumers, M., Brown, P., Charnley, F., Ford, S. J., Garmulewicz, A., Knowles, S., Minshall, T. H. W., Mortara, L., Reed-Tsochas, F. P. and Rowley, J. (2017), 'Unlocking value for a circular economy through 3D printing: A research agenda', *Technological Forecasting and Social Change*, 115: pp. 75–84, doi:10.1016/j.techfore.2016.09.021.
54 UTEC (2020), 'COINNOVACIÓN COVID-19: LA PALTAFORMA DE INNOVACIÓN ABIERTA CON APOYO ORGANIZACIONAL DE UTEC' [CO-INNOVATION COVID-19: THE OPEN INNOVATION PLATFORM WITH SUPPORT FROM UTEC], https://utec.edu.uy/coinnovacion-covid-19-la-plataforma-de-innovacion-abierta-con-apoyo-organizacional-de-utec/ (accessed 18 Aug. 2020).

02
LAC institutions and policies

The multi-sector approach of the circular economy poses a major challenge to the institutions of LAC. Strong institutions and policies are key to the success of the circular economy transition.

Institutional arrangements for accelerating the circular economy transition

Achieving circular economic development in LAC will require more transparent and accountable institutions across the region. Transparent democratic processes, supported by robust and accountable institutions, have been proven to have a strong bearing on the capacity of governments in Latin America to achieve economic development.[55] Strong institutions are associated with high transparency, effective public spending and fiscal responsibility.[56] This suggests that policymakers should take action to strengthen institutions in order to boost development, including circular economy initiatives.

There are important institutional and governance issues that are especially necessary to accelerate the adoption and implementation of a circular economy agenda in Latin America:

— The circular economy cuts across sectors and institutional boundaries. In general, it is misunderstood as solely an environmentally sustainable model. Thus, it is not surprising that Latin American environment ministries tend to be both the promoters and hosts of circular economy initiatives. However, the circular economy is just as relevant to the industrial sector as it is to the environment.

55 Grassi, D. and Memoli, V. (2015), 'Political Determinants of State Capacity in Latin America', *World Development,* 88: pp. 94–106, doi:10.1016/j.worlddev.2016.07.010 (accessed 17 Jun. 2020).
56 Vianna, A. and Mollick, A. (2018), 'Institutions: Key variable for economic development in Latin America', *Journal of Economics and Business,* 96: pp. 42–58, doi:10.1016/j.jeconbus.2017.12.002 (accessed 17 Jun. 2020).

As government ministries normally tend to work in 'silos', each being strictly accountable for particular programmes, the multi-sector approach of the circular economy model poses a major challenge to their institutional structures. The truth is that individual sectoral ministries, acting in isolation, are likely to face major obstacles in accelerating the circular economy agenda.

— Different approaches can be applied to resolve these institutional conundrums. First, inter-ministerial cooperation can facilitate policy coherence and firmly embed the circular economy approach in government business. For instance, the government of Chile created a circular economy unit within the Ministry of the Environment, which has forged strong links with the state economic development agency (Corporación de Fomento de la Producción – CORFO) and the Sustainability and Climate Change Agency (Agencia de Sustentabilidad y Cambio Climático – ASCC). This has resulted in a successful inter-agency collaboration to develop a circular economy roadmap, as well as a programme to finance innovative circular opportunities in Chile. Second, given the overarching nature of the circular economy agenda, other countries have relied on horizontal supra-ministerial institutions that have a stronger planning mandate but can still give strategic guidance for implementation at the sectoral or ministry level. For instance, in Uruguay, the Planning and Budget Office (OPP) within the office of the president has embraced the circular economy and incorporated it into its National Plan for Productive Transformation and Competitiveness, with sectoral ministries retaining responsibility for implementation.

— A major barrier to the implementation of a circular economy agenda in LAC is the lack of private-sector involvement. Firms are still broadly sceptical of the circularity concept, which is still frequently perceived as an 'environmental tax' on productive activity. If ministries of the environment are the only institutions to embrace the circular economy it may intensify this perception and reduce the uptake of related policies, such as extended producer responsibility (EPR) waste management regulations. Private-sector companies need to understand the value that the circular economy may bring through efficient resource usage and by generating value out of waste. In some countries, the private sector has already proved an important driving force behind the adoption of the circular economy. In Argentina, for instance, a private-sector coalition led by the Association for the Study of Solid Waste (ARS) has developed a National Strategy for the Circular Economy, inviting the government to strengthen the regulatory framework to support businesses in transitioning towards circularity.[57]

— Suppressed economic growth, due to falling commodity prices since 2011, has contributed to dramatic changes in government in some countries. Voters have favoured populist parties that promise prosperity, as occurred in 2018 in both Brazil and Mexico. There are concerns across the region that, in order to pursue economic growth, some incoming governments are reversing important gains in institutional accountability, peace, social protection and equity, and relaxing environmental protections,[58] which would threaten the achievement of many

57 Association for the Study of Solid Waste (ARS) (2019), *Estrategia Nacional de Economía Circular [National Circular Economy Strategy]*, http://ars.org.ar/destacados/estrategia-ancional-de-economia-circular (accessed 19 May 2020).
58 Lobos Alva, I. and Rueff, H. (2019), *Latin America Experts Identify Three Priorities for Supporting SDG Progress in the Region*, IISD, 7 March 2019, https://sdg.iisd.org/commentary/guest-articles/latin-america-experts-identify-three-priorities-for-supporting-sdg-progress-in-the-region/ (accessed 9 Mar. 2020).

social, environmental and economic SDGs and hinder a transition to an inclusive circular economy. In the context of the COVID-19 crisis such concerns have been exacerbated, with Mexican President Andrés Manuel López Obrador announcing in May 2020 an expansion of the role of the armed forces in public security,[59] while criminal groups in Mexico and Brazil have been engaged in the distribution of aid and in imposing curfews on some of the lowest-income sections of those countries' populations, where there has been a lack of state intervention.[60] The absence of state accountability and social protection risks leaving the poorest members of society behind in a transition to the circular economy, leading to less resilient societies and missed opportunities to progress towards the SDGs.

Box 4. Institutional support for social innovation

Supporting social innovation can be a promising approach for promoting an inclusive circular economy in LAC. Social innovation can be defined as 'a novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals.'[61] Social innovation is a central component of a theory of social change, in which the variety of everyday inventions on the micro level can lead to changing wider social practices.[62]

There is a long history in LAC of social innovation promoting health, education, food and energy security, social responsibility and sustainable development, where government institutions have failed.[63] The SI-DRIVE initiative (Social Innovation: Driving Force of Social Change),[64] which conducted a global survey of social innovation projects, found that more than half of the programmes surveyed in Latin America successfully shared their social innovations with projects in other territories, but only at the local level. Non-governmental organizations were essential for the implementation of most of these initiatives. However, without sufficient state support at local, subnational and national levels these social innovations lack scalability.

There are some examples of social innovation initiatives supported by national governments in Latin America. Argentina, Colombia and Chile have all embedded social innovation programmes within government ministries. For instance, in 2012, the Colombian government founded the Colombian Centre for Social Innovation, which sits within the

59 Agren, D. (2020), 'López Obrador accused of militarizing Mexico with new security decree', *Guardian,* 11 May 2020, https://www.theguardian.com/world/2020/may/11/mexico-lopez-obrador-armed-forces-decree (accessed 17 Jun. 2020).
60 Felbab-Brown, V. (2020), 'Mexican cartels are providing COVID-19 assistance: Why that's not surprising', *Brookings,* 27 April 2020, https://www.brookings.edu/blog/order-from-chaos/2020/04/27/mexican-cartels-are-providing-covid-19-assistance-why-thats-not-surprising/ (accessed 17 Jun. 2020); Barretto Briso, C. and Phillips, T. (2020), 'Brazil gangs impose strict curfews to slow coronavirus spread', *Guardian,* 25 March 2020, https://www.theguardian.com/world/2020/mar/25/brazil-rio-gangs-coronavirus (accessed 17 Jun. 2020).
61 Phills Jr., J., Deiglmeier, K., Miller, D. (2018), 'Rediscovering Social Innovation', *Stanford Social Innovation Review*. 2008, Vol. 6, Issue 4. https://ssir.org/articles/entry/rediscovering_social_innovation#bio-footer (accessed 7 Sep. 2020).
62 Howaldt, J., Kopp, R. and Schwarz, M. (2015), 'On the theory of social innovations: Tarde's neglected contribution to the development of a sociological innovation theory', Weinheim: Beltz Juventa, https://nbn-resolving.org/urn:nbn:de:0168-ssoar-419633 (accessed 7 Sep. 2020).
63 ECLAC (2020), 'Experiences in Social Innovation in Latin America and the Caribbean ECLAC-Kellogg', https://www.cepal.org/en/to ics/innovacion-social/experiences-social-innovation-latin-america-and-caribbean-eclac-kellogg (accessed 17 Jun. 2020).
64 Social Innovation: Driving Force of Social Change (SI-DRIVE) (2015), *Social Innovation Strategies – Regional Report D 3.6*, http://www.si-drive.eu/wp-content/uploads/2018/03/D3.6-SI-DRIVE-Global-Region-Report-2015.pdf (accessed 7 Sep. 2020).

Department of Social Prosperity; Argentina launched its National Programme for Technology and Social Innovation in 2013; and Chile incorporated social innovation into the agenda of the national economic development agency, CORFO.[65] One successful example of social innovation that has benefited from strong government support at the city level is the cable car system in Medellín, Colombia, which was introduced in the early 2000's to provide transport into the city for the poorest people living in hillside communities – the initiative was supported by education and social programmes.[66]

Even so, government-backed social innovation programmes in LAC are generally more marginal, lacking the support to operate at scale. In Chile, for example, a group of young professionals, under the name Potential Chile, were able to design a product that retained 97 per cent of particulate emissions produced by combustion of biomass in domestic stoves, contributing to a reduction in air pollution in the city of Coyhaique without affecting the inhabitants' ability to heat their homes. Prototyping and testing of the product was funded in 2016–17 by the Ministry of Energy and CORFO. However, the project now needs further investment to enable it to be scaled up.[67] Policymakers must recognize the key role that social innovation has to play in a just transition to a circular economy.

Key policy measures for the circular economy in LAC

Most countries in the LAC region have introduced one or more of the six different types of policy measures that promote circular economy transitions:

- **National circular economy roadmaps and strategies:** Several governments – including those in Colombia, Chile, Ecuador, Peru and Uruguay – have developed, or are in the process of developing, dedicated circular economy roadmaps or strategies. Many countries have included circular economy elements in their national development plans and/or their environment and climate programmes, including targets for the recycling and reuse of waste materials as well as for linking circular economy and climate action, plans to stimulate innovation and job creation through the shift to a circular economy, and processes to bring together important national stakeholders.
- **Waste management policies:** All countries in LAC have introduced legislation on waste management. It is necessary to synchronize waste management policies with the concept of the circular economy and to align them with local and national government policies. Waste management policies should also take into consideration the greenhouse gas emission mitigation strategies

65 Domanski, D., Howaldt, J. and Schröder, A. (2017), 'Social Innovation in Latin America', *Journal of Human Development and Capabilities*, 18(2): pp. 307–12, doi:10.1080/19452829.2017.1299698 (accessed 19 May 2020).
66 Orejas, R. and Buckland, H. (2016), *Study of Social Entrepreneurship and Innovation Ecosystems in the Latin American Pacific Alliance Countries, Country Analysis: Colombia*, Inter-American Development Bank, https://publications.iadb.org/publications/english/document/Study-of-Social-Entrepreneurship-and-Innovation-Ecosystems-in-the-Latin-American-Pacific-Alliance-Countries-Country-Analysis-Colombia.pdf (accessed 18 Jun. 2020).
67 Espine, S. R. (2019), 'MPzero: Sustainable, Affordable and Clean Heating Available to Everyone', *Social Innovations Journal,* 53, https://socialinnovationsjournal.org/editions/issue-53/75-disruptive-innovations/2924-mpzero-sustainable-affordable-and-clean-heating-available-to-everyone (accessed 18 Jun. 2020).

needed to meet the targets of the Paris Agreement. A number of countries already have regulations for solid waste management that adopt a principle of shared responsibility.[68]

— **Extended producer responsibility (EPR):** This policy approach tasks certain producers of goods with the responsibility for recovering, treating or disposing of post-consumer waste, rather than it being the sole responsibility of national, subnational or local authorities. Such schemes could provide incentives to minimize waste at the source, promote more environmentally conscious product design, and support public-sector management of waste. Eight countries – Brazil, Colombia, Chile, Costa Rica, Honduras, Mexico, Peru and Uruguay – have established an EPR scheme to some degree for a number of product categories, including e-waste, batteries and tyres.

— **Material resource efficiency and recycling targets:** Material resource efficiency refers to the sustainable use of resources – through reduced use, optimization and recycling – to produce the same level of output. Material resource efficiency can be supported through efficient practices such as lean production and lifetime optimization, and can help with a range of environmental issues, including climate change mitigation and a reduction in water consumption and waste. Government policies across LAC have generally been slow to introduce resource-efficient production practices, as a result the region's economies and industries are characterized by an intensive use of natural resources. In the LAC, material intensity – a measure of the amount of materials required for the provision of a good or service (usually expressed as a ratio of materials used to value) – is over one and a half times the global average.[69] Of 33 LAC countries, 18 have plastics regulations, in general aiming to reduce superfluous plastics packaging and increase recycling.[70] Under the Chilean Plastics Pact initiative (rebranded as Circula El Plástico in 2019), the country has put forward targets to ensure one-third of all plastic packaging is effectively reused, recycled or composted, and to incorporate 25 per cent recycled content into plastic packaging by 2025.[71]

— **Fiscal policies (including taxation, incentives and subsidy removal):** Public fiscal policies can provide macroeconomic support to industries and businesses that aim to shift to the circular economy model. These fiscal policies can include tax incentives (such as virgin material taxation or clean technology tax exemptions) or subsidy removal (for example, the elimination of virgin resource subsidies). An example from Uruguay is the introduction in 2003 of a tax exemption for machinery and premises intended for lead-acid battery recovery and recycling operations. Fiscal policies can complement other policy measures that support the circular economy. For example, the banning of plastic bags in Antigua and Barbuda was accompanied by tax exemptions for reusable

68 Guarnieri, P., Cerqueira-Streita, J. and Batista, L. (2020), 'Reverse logistics and the sectoral agreement of packaging industry in Brazil towards a transition to circular economy', *Resources, Conservation and Recycling,* 153, 104541, doi:10.1016/j.resconrec.2019.104541 (accessed 17 Jun. 2020).
69 West, J. and Schandl, H. (2013), 'Material use and material efficiency in Latin America and the Caribbean', *Ecological Economics*, 94: pp. 19–27, doi:10.1016/j.ecolecon.2013.06.015 (accessed 17 Jun. 2020).
70 UN Environment Programme (2019), *Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations,* https://wedocs.unep.org/bitstream/handle/20.500.11822/27113/plastics_limits.pdf (accessed 22 Jun. 2020).
71 Ellen MacArthur Foundation (2019), 'Chilean Plastics Pact: 2025 targets announced', 7 April 2019, https://www.newplasticseconomy.org/news/chile-announces-plastics-pact-targets (accessed 17 Jun. 2020).

bag imports in 2016,[72] and a yearly incremental tax allocation for single-use plastic bags was implemented in Peru in 2018.[73] Lastly, it is also important to evaluate and remove potential fiscal barriers. In Brazil, for example, recycled material is subject to double taxation, thus removing any incentive to use it as opposed to virgin materials.[74]

— **Product policies (including eco-design, single-use product bans and product lifetime extension):** There are not many existing examples of these initiatives in LAC countries, beyond single-use product bans. A number of national governments have approved bans on certain types of single-use plastics, for example Costa Rica's ban on the import, marketing, and distribution of polystyrene containers, as part of a national strategy to drastically reduce the use of disposable plastics by 2021. Product lifetime extension and eco-design are a step further in the direction of the circular economy. Product lifetime extension refers to the refurbishment and remanufacturing of a product or component to return it to its original quality thereby extending its usage.

Eco-design for existing products can optimize the remanufacturing process, further saving resources. Eco-design for new products can include design principles such as designing for energy efficiency, reparability, recyclability, minimization of packaging and chemical safety. Product design as it is needs to change considerably in order to fit into a circular economy.

In Brazil, a number of examples show how modular design and integrating shared transport services into real estate offerings can make efficiency savings for both construction and transportation. For example, modular design was incorporated into some of the venues for the Rio Olympic Games in 2016, with structures that could be removed, rebuilt, and repurposed. And in a number of São Paulo apartment buildings, a Brazilian real estate developer has launched residential buildings with shared car, motorcycle and bicycle hire schemes.[75] However, many products such as electronics and cars are not originally produced in the region. Eco-design standards need to be global or they will be limited to certain products and sectors.

According to respondents to the Chatham House survey, the most important policies to advance the circular economy transition in LAC countries are the introduction of improved waste management and waste prevention policies, fiscal policies and EPR schemes. Respondents also highlighted the wider need for policy harmonization across the circular economy, sustainable development and climate change agendas and the importance of integrating policy measures that support the circular economy into other cross-cutting national-level policies, such

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72 UN Environment Programme (2018), *Waste Management Outlook for Latin America and the Caribbean*, Panama City: UN Environment, Latin America and the Caribbean Office, https://www.unenvironment.org/ietc/resources/publication/waste-management-outlook-latin-america-and-caribbean (accessed 17 Jun. 2020).
73 Gobierno del Perú (2018), 'Ley No. 30884 – Ley que regula el plástico de un solo uso y los recipientes o envases descartables', 19 December 2018, https://sinia.minam.gob.pe/normas/ley-que-regula-plastico-un-solo-uso-recipientes-envases-descartables (accessed 22 Jun. 2020).
74 Talarico, T. (2017), 'BIN THERE, (NOT) DONE THAT: Brazil's Recycling Potential', UNDP World Centre for Sustainable Development, 23 August 2017, https://riopluscentre.org/blogs/brazil-loses-billions-every-year-for-not-recycling (accessed 16 Jun. 2020).
75 Ellen MacArthur Foundation (2017), 'A Circular Economy in Brazil: An initial exploration', https://www.ellenmacarthurfoundation.org/assets/downloads/A-Circular-Economy-in-Brazil-An-initial-exploration.pdf (accessed 16 Jun. 2020).

as infrastructure development. Furthermore, to enable just transitions, policies and legislation relating to labour rights are fundamental to inclusive circular economy structures. For example, in 2019, Mexico updated its Federal Labour Law, which has removed barriers for workers wishing to access the justice system.[76]

Map 1. Summary of key circular economy policy measures

Source: Compiled by the authors.
Note: A more extensive database of circular economy policies in LAC will be published by Chatham House in November 2020 at https://circulareconomy.earth/.

76 Birtwistle, S. (2019), 'Constitutional Labour Reform in Mexico: and now what?', Laudes Foundation, 30 October 2019, https://www.laudesfoundation.org/latest/blog/2019/10/constitutional-labour-reform-in-mexico-and-now-what (accessed 17 Jun. 2020).

Box 5. Circular economy frontrunners in LAC

The following case studies highlight the leading proponents of the circular economy in the region. Their experiences shed light on the current state of policy design, implementation challenges and sectoral opportunities.

Colombia

After hosting the first Circular Economy Forum of the Americas in 2017, Colombia launched its National Strategy for the Circular Economy 2018–22 in November 2018 (Estrategia Nacional de Economía Circular– ENEC),[77] with an updated version published in July 2019.[78] The strategy aims to increase the rate of recycling and reuse of waste materials from 8.7 per cent in 2019 to 17.9 per cent by 2030.[79] While this is the first strategy explicitly focusing on the circular economy in Colombia, this is not the first time that the country has created strategies and policies on green growth, sustainable production and waste management. The government produced a National Policy on Sustainable Production and Consumption in 2010[80] and green growth components – transforming the economy, generating low-carbon public policies and incentives, and increasing the involvement of the private sector – were included in its National Development Plan for 2014–18. A commercial carbon tax was passed into law in 2017; in October of that year, within months of its implementation, one of the country's largest producers of concrete, Cemex, announced that it had become carbon neutral.[81]

Colombia was one of the first countries in the region to adopt EPR policies, introducing EPR into its first national policy on hazardous waste management, Decree 4741 of 2005, which regulates the prevention and management of hazardous residue and waste.[82] In 2007, Colombia started implementing an EPR scheme to manage several end-of-life products containing hazardous waste materials, such as pesticide containers, expired medicines and lead-acid batteries. Light bulbs, small batteries, computers, mobile phones, and other household products as well as used tyres were added in 2010. The EPR scheme aims, in particular, to deal in an environmentally appropriate way with the estimated 110,000

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77 Gobierno de Colombia, Ministerio de Ambiente y Desarrollo Sostenible (Minambiente) (2019), 'Estrategia nacional de economía circular– ENEC' [National Strategy for the Circular Economy], Consejo Colombiano de Construcción Sostenible, https://www.cccs.org.co/wp/download/comite-tecnico-actualizacion-de-la-estrategia-nacional-de-economia-circular-del-ministerio-de-ambiente-y-desarrollo-so/%20?wpdmdl=19635 (accessed 16 Aug. 2019).
78 Gobierno de Colombia, Ministerio de Ambiente y Desarrollo Sostenible/Ministerio de Comercio Industria y Turismo (2019), *Estrategia Nacional de Economía Circular: Cierre de ciclos de materiales, innovación tecnológica, colaboración y nuevos modelos de negocio* [National Strategy for the Circular Economy: Closing material loops, technological innovation, collaboration, and new business models], Bogotá, DC: Presidencia de la República, http://www.andi.com.co/Uploads/Estrategia%20Nacional%20de%20EconA%CC%83%C2%B3mia%20Circular-2019%20Final.pdf_637176135049017259.pdf (accessed 14 Jun. 2020).
79 *El Nuevo Siglo* (2019), 'Colombia lanza primera Economía Circular en América Latina' [Colombia launches the first Circular Economy in Latin America], 14 June 2019, https://www.elnuevosiglo.com.co/articulos/06-2019-colombia-lanza-primera-economia-circular-en-america-latina (accessed 15 Aug. 2019).
80 Gobierno de Colombia, Ministerio de Ambiente y Desarrollo Sostenible (Minambiente) (2019), 'Producción y Consumo Sostenible' [Sustainable Production and Consumption], http://www.minambiente.gov.co/index.php/component/content/article/154-plantillaasuntos-ambientales-y-sectorial-y-urbana-7#políticas (accessed 16 Aug. 2019).
81 Ballesteros, A. (2017), 'Colombia's carbon tax shows early signs of success', Colombia Reports, 10 October 2017, https://colombiareports.com/colombias-carbon-tax-shows-early-signs-success/ (accessed 16 Aug. 2019).
82 Gobierno de Colombia, Ministerio de Ambiente, Vivienda y Desarrollo Territorial (2005), *Por el cual se reglamenta parcialmente la prevención y el manejo de los residuos o desechos peligrosos generados en el marco de la gestion integral* [Whereby the prevention and management of waste and hazardous waste generated within the framework of integrated waste management is partially regulated], Decreto Número 4741 de 2005, http://www.ideam.gov.co/documents/51310/526371/Decreto+4741+2005+PREVENCION+Y+MANEJO+DE+REIDUOS+PELIGROSOS+GENERADOS+EN+GESTION+INTEGRAL.pdf/491df435-061e-4d27-b40f-c8b3afe25705 (accessed 4 Aug. 2020).

tonnes of e-waste generated annually.[83] However, the effective implementation and administration of the EPR system requires further improvement of the legal framework by defining clear targets. It also requires the active participation and collaboration of key actors in the product chain through legal requirements and economic instruments.[84]

Colombia has also been developing several strategies around the bioeconomy. At the World Economic Forum in 2016, the country announced its strategy for economic development, based on agro-industry, the service sector and tourism. In addition, the country's National Planning Department conducted a Green Growth Mission, which proposed a shift to more socially inclusive, and resource-efficient, sustainable production processes.[85]

Chile

In recent years, the Chilean government has introduced several policies and strategies aiming to promote the transition to a circular economy. Among LAC countries, Chile has the most public initiatives devoted to the circular economy. In 2016, the country adopted Framework Law No. 20,920 for Waste Management, Extended Producer Responsibility and the Promotion of Recycling. It aims to protect public health and the environment by reducing the generation of waste as well as promoting recycling, reuse and other forms of valorization. The law established an EPR scheme and sought, *inter alia*, to enhance the inclusion of unofficial 'waste pickers'.[86] In 2018, Chile banned the commercial use of plastic bags, despite fervent efforts by the national plastics industry to block the process.[87] Other examples of Chile's engagement include the programme Construye 2025 (Build 2025), which seeks to promote sustainability and circularity within the construction sector,[88] and the National Programme on Sustainable Consumption and Production, which covers areas such as sustainable construction, sustainable industry, sustainable lifestyles and waste management. The implementation of the latter is supported by the National Action Plan on Sustainable Consumption and Production (2017–22).[89] Finally, the Chilean Plastics Pact initiative (Circula El Plástico, since 2019) brings together stakeholders from a range of sectors to promote a circular economy for plastics.

Uruguay

In 2016, Uruguay established the National System for Productive Transformation and Competitiveness (Transforma Uruguay), approved through Law 19472, with the commitment to promote productive and innovative economic development in the country. Participation in the design and implementation of Transforma Uruguay was not limited to government, it also included other public and private stakeholders, and incorporated social dialogue.

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83 Sustainable Recycling Industries (2019), 'Colombia', SRI, https://www.sustainable-recycling.org/recycling-initiatives/colombia/ (accessed 16 Aug. 2019).
84 Park, J., Díaz-Posada, N. and Mejía-Dugand, S. (2018), 'Challenges in implementing the extended producer responsibility in an emerging economy: The end-of-life tire management in Colombia', *Journal of Cleaner Production,* 189: pp. 754–62, doi:10.1016/j.jclepro.2018.04.058 (accessed 21 Jul. 2020).
85 Henry, G., Hodson, E., Aramendis, R., Trigo, E. and Rankin, S. (2017), *Bioeconomy: an engine for integral development of Colombia*, CIRAD, CIAT and the EU Commission, https://agritrop.cirad.fr/589172/1/Bioeconomy_An_engine_for_the_integral_development_of_Colombia.pdf (accessed 16 Aug. 2019).
86 Gobierno de Chile, Ministerio del Interior y Seguridad Pública (2016), *Diario Oficial de la República de Chile*, No. 41.472, 1 June 2016, https://mma.gob.cl/wp-content/uploads/2015/06/do-20160601-web.pdf (accessed 16 Aug. 2019).
87 Howard, B. C., Gibbens, S., Zachos, E. and Parker, L. (2019), 'A running list of action on plastic pollution', *National Geographic*, 10 June 2019, https://www.nationalgeographic.com/environment/2018/07/ocean-plastic-pollution-solutions/ (accessed 17 Aug. 2019); BBC (2018), 'Chile bans plastic bags for businesses', 3 August 2018, https://www.bbc.co.uk/news/world-latin-america-45066268 (accessed 3 Dec. 2019).
88 Construye2025 (2019), '¿Qué es Construye2025?'[What is 'Build 2025'?], http://construye2025.cl/que-es-construye-2025/ (accessed 20 Aug. 2019).
89 Gobierno de Chile, Ministeriodel Medio Ambiente (2016), *Programa Nacional de Consumo y Producción Sustentables* [National Sustainable Consumption and Production Programme], https://mma.gob.cl/wp-content/uploads/2016/07/ccps_13072016_alta.pdf (accessed 23 Aug. 2019).

The final result of this process was the creation of a Circular Economy National Action Plan, which aims to strengthen human capacity; increase productivity and net savings in production costs; increase green job opportunities; achieve a greater visualization of initiatives and citizen participation; introduce greater innovation; and to bring about a reduction in CO_2 emissions and negative impacts on watercourses and soil. Four ministries were involved in the design, and advisory councils were created to integrate workers, entrepreneurs, and academic institutions in the process.

The National Action Plan is made operational through projects such as Biovalor, which is funded by the Global Environment Facility (GEF), implemented by the UN Industrial Development Organization (UNIDO) and executed by three Uruguayan ministries. It aims to generate value from the waste derived from agro-industrial activities. Biovalor supported the Uruguayan National Development Agency (Agencia Nacional de Desarrollo – ANDE) in the design and implementation of the Oportunidades Circulares programme, which provides funding and other forms of support to circular economy start-ups. Biovalor has also developed its own project, Circularidad de Nutrientes en Tambos, an initiative to restore nutrient circularity in dairy farms.[90]

The Uruguayan government is also developing a national strategy for the bioeconomy,[91] and recently launched a road map for Uruguay's forestry sector.[92] Since 2014, ECLAC, the World Bank and the World Wildlife Fund have identified Uruguay as a 'green energy leader'.[93] As early as 2004, its government introduced a law with the purpose of promoting reuse, recycling and recovery of packaging.[94] The promotion of the circular economy and the bioeconomy are included in Uruguay's national development plan.[95]

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90 Biovalor (2019), 'Circularidad de Tambos' [Circularity in Dairy Farms], https://biovalor.gub.uy/circularidad-nutrientes/ (accessed 17 Jul. 2020); Biovalor (2019), 'Qué es Biovalor?' [What is Biovalor ?], https://biovalor.gub.uy/circularidad-nutrientes/ (accessed 22 Aug. 2019).
91 FAO en Uruguay (2018), 'Uruguay rumbo a una estragia nacional en bioeconomía' [Uruguay is going towards a national strategy for the bioeconomy], 19 February 2018, http://www.fao.org/uruguay/noticias/detail/es/c/1103089/ (accessed 22 Aug. 2019).
92 Transforma Uruguay (n.d.), 'Hoja de Ruta Forestal Madera' [Roadmap for the Timber Sector], https://www.transformauruguay.gub.uy/es/documentos/forestal-madera.pdf (accessed 22 Aug. 2019).
93 Watts, J. (2015), 'Uruguay makes dramatic shift to nearly 95% electricity from clean energy', *Guardian*, 3 December 2015, https://www.theguardian.com/environment/2015/dec/03/uruguay-makes-dramatic-shift-to-nearly-95-clean-energy (accessed 22 Aug. 2019).
94 UN Development Programme and UN Environment Programme (2013), 'Sharing the waste, sharing the wealth: Uruguay uses the law to catalyse the transition to an inclusive green economy' in *Stories of Change from the Joint UNDP-UNEP Poverty-Environment Initiative*, pp. 41–6, http://hdl.handle.net/20.500.11822/32434 (accessed 16 Jun. 2020).
95 Presidencia de la República Oriental del Uruguay, Oficina de Planeamento y Presepuesto (2019), *Aportes para una Estrategia de Desarrollo 2050* [Contributions towards the 2050 Development Strategy], pp. 53, 170, https://observatorioplanificacion.cepal.org/sites/default/files/plan/files/Estrategia_Desarrollo_2050.pdf (accessed 3 Dec. 2019).

03 Challenges and opportunities in LAC

The LAC transition to a circular economy relies on three priority sectors – mining, waste management and the bioeconomy. Each must adapt to contend with the challenges and opportunities ahead.

Extractives and mining

The extractive industries play an important role in the economies of many LAC countries. For instance, in both Ecuador and Colombia, petroleum oils, oils from bituminous materials and crude oil accounted for approximately 30 per cent of export revenues in 2017.[96] Similarly, the mining sector plays a prominent role in the economies of Brazil, Chile, Colombia, Guyana and Peru. Brazil has the fourth largest mining sector in the world and is a global player due to its exports of niobium (for which it is the world's leading exporter), iron ore (3rd), manganese (5th), tantalum (2nd), graphite (3rd) and bauxite (3rd).[97]

Several of the technologies necessary for the low-carbon transition require a range of base and precious metals including copper, lithium, gold, uranium, rare earth metals, silver and zinc.[98] According to a World Bank report, and under

96 UN Conference on Trade and Development (2019), *State of Commodity Dependence 2019*, Geneva: UN, pp. 82, 215, https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=2439 (accessed 4 Dec. 2019).
97 Xavier, L., Giese, E., Ribeiro-Duthie, A. and Lins, F. (2019), 'Sustainability and the circular economy: A theoretical approach focused on e-waste urban mining', *Resources Policy*, 101467, doi:10.1016/j.resourpol.2019.101467 (accessed 15 Jun. 2020).
98 Bartels, R., Drewell, Q. and Morrison, H. (2019), *Mining new value from the circular economy*, Accenture, https://www.accenture.com/_acnmedia/pdf-98/accenture-circular-economy-in-mining.pdf (accessed 27 Nov. 2019).

the International Energy Agency's 2°C scenario,[99] production of graphite, lithium and cobalt will need to increase globally by more than 450 per cent by 2050 from 2018 levels to meet demand from energy storage technologies.[100] At present, demand for the majority of these resources exceeds the amounts that can be obtained through recycling and urban mining (the process of reclaiming raw materials from spent products, buildings and waste).[101] Primary extraction of these resources is therefore likely to continue for some time yet.

In the long term, material scarcity and the transition to a circular economy – with its emphasis on reuse, sharing, prolonged use and recycling – is expected to reduce the need for extraction of primary materials.

In the long term, however, material scarcity and the transition to a circular economy – with its emphasis on reuse, sharing, prolonged use and recycling – is expected to reduce the need for extraction of primary materials.[102] This would potentially have negative implications for workers, communities, regions and countries that are specialized in this economic activity.[103] Of the top 50 countries that rely on extractives, 64 per cent are classified as low and middle-income countries, and these states stand to lose disproportionately from a circular economy transition, compared to the rest of the world.[104] This assertion is in line with the Chatham House survey results, in which over 40 per cent of respondents believed that extractive industries would face the biggest challenges in the circular economy transition in the LAC region, due to reduced demand for some primary materials and the impact of predicted regulatory limitations that would be imposed on industries relying on linear business models. The pace at which major economic powers such as the EU and China move towards circular economies is likely

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99 Scenario with at least a 50 per cent chance of limiting the average global temperature increase to 2°C: see International Energy Agency (2017), *Energy Technology Perspectives 2017*, Paris: IEA, https://www.iea.org/reports/energy-technology-perspectives-2017.
100 Hund, K., La Porta, D., Fabregas, T., Laing, T. and Drexhage, J. (2020), *Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition*, International Bank for Reconstruction and Development/The World Bank, Climate-Smart Mining Initiative, Washington, DC: World Bank Publications, p. 11, http://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf (accessed 19 May 2020).
101 SINTEF (2020), 'Urban Mining', https://www.sintef.no/en/urban-mining/ (accessed 4 Aug. 2020); Bartels, Drewell and Morrison (2019), *Mining new value from the circular economy*.
102 International Labour Organization (2018), *World Employment Social Outlook 2018: Greening with Jobs*, Geneva: ILO, https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_628654.pdf (accessed 23 Nov. 2019); Circle Economy (2019), *The Circularity Gap Report 2019*, p.14, https://bfc732f7-80e9-4ba1-b429-7f76cf51627b.filesusr.com/ugd/ad6e59_ba1e4d16c64f44fa94fbd8708eae8e34.pdf (accessed 23 Nov. 2019).
103 McCarthy, Dellink and Bibas (2018), 'The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches'.
104 Ericsson, M. and Löf, O. (2019), 'Mining's contribution to national economies between 1996 and 2016', *Mineral Economics*, 32: pp. 223–50, doi:10.1007/s13563-019-00191-6 (accessed 23 Nov. 2019).

to accelerate this scenario. For example, if China were to develop a circular economy for steel, this would potentially prove problematic for countries such as Brazil that are currently suppliers and exporters of iron ore.[105]

The circular economy model offers an opportunity to reduce the significant environmental and social impacts of the extractives and mining sector across the LAC region. Mining activities are highly water- and energy-intensive. Furthermore, the use of toxic substances in the extraction of minerals and metals – such as the use of mercury in gold mining – has serious health implications for workers and local communities,[106] due to the contamination of soils and water supplies by mining residues (known as tailings) containing these hazardous substances.[107] Land clearance and land-use change to enable extractive activities contributes in many cases to deforestation, habitat loss, erosion and sedimentation.[108] The 2019 disaster at the Córrego do Feijãoir mine near Brumadinho, Brazil, where a tailings dam collapsed, killing 270 people and destroying forest land and polluting a nearby river, provides an example of the most catastrophic, worst-case consequences of mining activities.[109] The severe environmental, social and health consequences of badly managed mining activities are a major cause of increasing public resistance to new mining projects. Such impacts, coupled with the increased incidence of illegal mining activities and the frequent failure of mining companies to seek approval from local communities for new extractive projects, have led to protests and social unrest across many LAC countries, which in turn have entailed delays to a number of proposed projects.[110] The implementation of inclusive and just natural resource and environmental governance systems, together with sustainable and circular principles, when planning and designing mining operations can maintain the sector's operating mandate in the LAC region.[111]

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105 Nechifor, V., Calzadilla, A., Bleischwitz, R., Winning, M., Tian, X. and Usubiaga, A. (2020), 'Steel in a circular economy: Global implications of a green shift in China', *World Development,* 127 (104775), doi:10.1016/j.worlddev.2019.104775 (accessed 23 Nov. 2019).
106 Long Sieber, N. and Brain, J. (2014), 'Health Impact of Artisanal Gold Mining in Latin America: A Mining Boom Brings Risk from Mercury Contamination', *ReVista Harvard Review of Latin America*, XIII (2): p. 66, https://revista.drclas.harvard.edu/book/health-impact-artisanal-gold-mining-latin-america (accessed 19 May 2020).
107 Harlow, D. E., Hurley, K., Fox, A., Vargas-Guerra, A. and Gibson, J. (2019), *Small-scale & artisanal mining: Impacts on biodiversity in Latin America*, The Cadmus Group LLC, USAID, https://www.land-links.org/wp-content/uploads/2019/10/ASM_White-Paper_USAID_FINAL_21March2019Final.pdf (accessed 19 May 2020).
108 Ibid.
109 Phillips, D. (2019), 'Brazil dam collapse: bodies pulled from toxic mud as hope fades for survivors', *Guardian*, 28 January 2019, https://www.theguardian.com/world/2019/jan/28/brazil-dam-collapse-mining-disaster-victim-search-latest-news (accessed 21 May 2020); Watson, K. (2020), '"Vale ended our lives": Broken Brumadinho a year after dam collapse', BBC News, 25 January 2020, https://www.bbc.co.uk/news/world-latin-america-51220373 (accessed 24 Jul. 2020).
110 Dannemann, V. (2019), 'Mining projects foment unrest across Latin America', *Deutsche Welle*, 16 September 2019, https://www.dw.com/en/mining-projects-foment-unrest-across-latin-america/a-50443084 (accessed 19 May 2020); Taylor, A. and Bonner, M. D. (2017), 'Policing Economic Growth: Mining, Protest, and State Discourse in Peru and Argentina', Latin American Research Review, 52(1): pp. 3–17, doi:10.25222/larr.63 (accessed 19 May 2020).
111 Bastida, A. E. (2018), 'Latin America's Policy Priorities on Mining and Sustainable Development, and Opportunities for EU Cooperation', European Policy Brief, Strategic Dialogue on Sustainable Raw Materials for Europe (STRADE) No. 05/2018, http://stradeproject.eu/fileadmin/user_upload/pdf/STRADE_PB_LATAM_policy.pdf (accessed 19 May 2020).

Box 6. Emergent circular economy approaches in Chile's mining sector

Chile holds 30 per cent of the world's copper reserves and is responsible for one-third of global production. Mining has been instrumental to Chile's sustained economic development: the International Copper Association estimates that for every $100 contributed by mining to the Chilean economy, at least another $36 is generated indirectly,[112] and salaries in mining regions are between 80–110 per cent higher than regional averages.[113] However, jobs are now coming under pressure, as the mining sector faces rising production costs: the gradual exhaustion of surface deposits of high-grade ore has led companies to shift towards using machinery to access ore of a similar quality through underground tunnels.[114] The copper-mining sector is also a significant and growing consumer of water and energy: it is anticipated that its water consumption will increase by 55 per cent over 2018 levels by 2029,[115] while by 2026 its demand for energy will increase by 53 per cent.[116] In addition, Chile's mining sector produces 1.6 million tonnes of tailings every single day.[117]

In the context of Chile's commitment to become carbon-neutral by 2050, the government's efforts to produce a national circular economy roadmap, and increasing copper mining production costs, the mining sector is focusing on innovation, technology and new methods of production. New government policies and public–private partnerships have emerged in response to the key challenges.

In 2019, the Chilean government agreed a new tailings clean-up rule, which requires companies applying for permits for new mining projects to address some of the 170 documented abandoned tailings in the country, as a compensation measure to offset any environmental impacts of their own proposed projects.[118] In addition, in 2019, a new platform was launched to provide information to the public about tailings management: it was also intended to act as an innovation exchange and repository for tailings research.[119] CORFO, the national development agency, launched a mining programme in 2017, and the public–private partnerships Expande and Alta Ley were created to explore innovation in the mining sector.

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112 International Copper Association (2018), 'The Socioeconomic Impact of Copper Mining in Chile', Copper Alliance, https://sustainablecopper.org/the-socioeconomic-impact-of-copper-mining-in-chile/ (accessed 16 Oct. 2019).
113 Voetmann, F. (n.d.), 'Natural Resources as a Driver for the SDGs – the Case of Chile and Copper Mining', Copper Alliance, https://sustainablecopper.org/natural-resources-as-a-driver-for-the-sdgs-the-case-of-chile-and-copper-mining/ (accessed 22 Jul. 2020).
114 Millan Lombrana, L. (2019), 'Machines Taking Over Jobs at Giant Copper Mine in Chile', *Insurance Journal*, 15 August 2019, https://www.insurancejournal.com/news/international/2019/08/15/536310.htm (accessed 16 Oct. 2019).
115 Chilean Copper Commission (COCHILCO) (2019), *Forecast for water consumption in the copper mining industry, 2018–2029',* Comisión Chilena del Cobre, https://www.cochilco.cl/Research/Forecast%20for%20water%20consumption%20in%20the%20copper%20industry,%202018-2029.pdf (accessed 21 May 2020).
116 Energy and Mines (2016), 'The Chilean Copper Commission Anticipates a 53% Growth of Mining Energy Consumption by 2026', https://energyandmines.com/2016/01/the-chilean-copper-commission-anticipates-a-53-growth-of-mining-energy-consumption-by-2026/ (accessed 16 Oct. 2019).
117 Kinnunen, P. and Kaksonen, A. (2019), 'Towards circular economy in mining: Opportunities and bottlenecks for tailings valorization', *Journal of Cleaner Production,* 228: pp. 153–60, doi:10.1016/j.jclepro.2019.04.171 (accessed 18 Jun. 2020).
118 Harris, P. (2019), 'Chile miners to help tailings clean-up', Mining Journal, 27 March 2019, https://www.mining-journal.com/sustainability/news/1359668/chile-miners-to-help-tailings-clean-up (accessed 17 Oct. 2019).
119 Bnamericas (2019), 'Chile launches "ideas bank" platform for tailings management', 12 July 2019, https://www.bnamericas.com/en/news/chile-launches-ideas-bank-platform-for-tailings-management (accessed 17 Oct. 2019).

CORFO's mining programme is providing $5.9 million in financing for the development of hydrogen-powered mining trucks, as well as supporting the development of solar power plants in the Atacama desert to provide renewable energy for mining activities.[120] CORFO has also called for national and international companies to create value-added solutions for the lithium produced by the domestic supplier Sociedad Química y Minera (SQM), whereby SQM must reserve a percentage of its lithium for delivery to Chilean-based manufacturers, who can then develop products such as lithium cathode materials and lithium-ion batteries. The scheme prioritizes producers who promote a circular economy, as well as the development of human capital.[121] While it is unclear whether this initiative is to form part of Chile's central circular economy strategy, it could be a first step in a process of moving from a mainly resource-exporting model to one in which higher-value products are developed within the domestic economy.

In another progressive move, the public–private partnership Alta Ley is supporting an innovation project led by Codelco Tech, a subsidiary of the state-owned Codelco copper mining corporation, to identify the precise concentrations of certain minerals considered to have future importance (such as germanium, gallium and tungsten) within existing tailings, and to establish a process that makes their extraction profitable.[122] This could offset losses in income resulting from the exhaustion of easily accessible high-grade ores.

Mining and metals companies operating on a business-as-usual basis in the LAC region place themselves at risk of being overtaken and left behind by those innovative companies that are addressing the social and environmental impacts of their activities. Such companies are responding to the circular economy transition by updating and diversifying their processes – coordinating upstream and downstream activities to recover precious materials in the most cost-effective way or planning to supplant traditional primary materials completely. Extending the lifetime of products and resources by anticipating and planning for future applications will become the norm in designing products and supply chains. Mining and metals companies will need to become much more engaged with downstream users of their materials to stay competitive in the circular economy.[123]

Furthermore, as the demand for high-tech products increases and the availability of strategic or critical raw materials shrinks over the longer term, advanced e-waste recycling and urban mining are emerging as important economic activities that can ensure both the supply of secondary resources and, under proper conditions, a source of decent work for waste pickers. In 2016, countries in the LAC region generated an estimated 4.2 million tonnes of e-waste. Within the region, Brazil is the largest generator of such waste, producing 1.5 million tonnes per year;

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120 Tsanova, T. (2016), 'Chile draws plans for more solar, green mining and storage', *Renewables Now*, 17 November 2016, https://renewablesnow.com/news/chile-draws-plans-for-more-solar-green-mining-and-storage-547316/ (accessed 17 Oct. 2019); FuelCellsWorks (2019), 'Government of Chile Supports Green Hydrogen', 3 March 2019, https://fuelcellsworks.com/news/government-of-chile-supports-green-hydrogen/ (accessed 17 Oct. 2019).
121 Bnamericas (2019), 'Chile's plan to add value to mining', 27 May 2019, https://www.bnamericas.com/en/interviews/chiles-plan-to-add-value-to-mining (accessed 17 Oct. 2019).
122 CESCO (2019), 'Tailings are an opportunity to advance towards a lower impact mining', 16 August 2019, http://www.cesco.cl/en/2019/08/16/tailings-are-an-opportunity-to-advance-towards-a-lower-impact-mining/ (accessed 17 Oct. 2019).
123 Thimmiah, S. (2014), 'Where are miners and metals companies in the circular economy?', *Guardian*, 20 February 2014, https://www.theguardian.com/sustainable-business/mining-metals-circular-economy (accessed 20 Mar. 2020).

followed by Mexico (1 million tonnes), and then Argentina (400,000 tonnes) in third place.[124] These statistics place Brazil in a strategic position to develop urban mining, given the existence within the region of a relatively strong legal framework related to e-waste management. Circular manufacturing of electronics – in particular, designing for disassembly – will support urban mining for e-waste. These business models can also be interpreted as an economic solution for social and environmental issues resulting from unsustainable e-waste management.

Box 7. E-waste management and urban mining in Argentina

UNIDO is currently implementing a project to strengthen national initiatives and regional cooperation around management of e-waste in the LAC region, financed by the GEF.[125] One of the studies carried out by the International Labour Organization (ILO), as part of the project, has shown that activities surrounding the collection, treatment, waste disposal and material recovery of waste electrical and electronic equipment (WEEE) could directly generate 1,200 jobs in Argentina, with a further 33,000 positions created in the repair sector as a whole.[126] However, the study also found that WEEE recycling does not yet reach 2 per cent of total waste generation in Argentina. The low volume and discontinuous supply of materials limit growth for the sector, not just in Argentina, but in other countries across the region. To overcome this obstacle, the project recommends moving towards the integration of different processes at a regional level, evaluating the feasibility of specialization according to the installed capacities and technical experience in different LAC countries. The study in Argentina also highlighted the need to develop national standards on WEEE management criteria where these do not already exist, and to adequately regulate EPR schemes.

Another way of addressing the negative impacts on countries that are heavily dependent on the extractives and mining sector, and of facilitating global cooperation, would be through new models of leasing metals and minerals. The mined minerals or the manufactured metals could be leased to overseas companies, while ownership would remain with the country of origin. The idea is that the resource, in whichever form, is leased for a certain period of time and then returned. A failure to return would necessitate the purchase at a premium price.[127] This type of leasing mechanism, governed through a multilateral institution, would ensure the retention of long-term ownership of natural resources (and the benefits of such ownership) for countries in the Global South. It would also provide incentives for recycling and improved design of high-tech equipment and electronics. Other governance measures that could be undertaken at country level to ensure a just transition and resilience against the immediate impacts of a drop in demand for virgin materials would entail diverting revenues to a national fund or awarding direct cash transfers to affected communities and workers.

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124 Xavier, Giese, Ribeiro-Duthie and Lins (2019), 'Sustainability and the circular economy: A theoretical approach focused on e-waste urban mining'.
125 Global Environment Facility (n.d.), 'Strengthening of National Initiatives and Enhancement of Regional Cooperation for the Environmentally Sound Management of POPs in Waste of Electronic or Electrical Equipment (WEEE) in Latin-American Countries', https://www.thegef.org/project/strengthening-national-initiatives-and-enhancement-regional-cooperation-environmentally (accessed 18 Jun. 2020).
126 Maffei, L. and Burucua, A. (2020), *Residuos de Aparatos Eléctricos y Electrónicos (RAEE) y empleo en la Argentina [E-waste and employment in Argentina]*, International Labour Organization, https://www.ilo.org/buenosaires/publicaciones/WCMS_737650/lang--es/index.htm (accessed 18 Jun. 2020).
127 Hagan, A., Tost, M., Inderwildi, O., Hitch, M. and Moser, P. (2019), 'The license to mine: Making resource wealth work for those who need it most', *Resources Policy,* 101418, doi:10.1016/j.resourpol.2019.101418 (accessed 16 Jun. 2020).

Municipal waste management and recycling

The LAC is the most urbanized region in the world with more than 80 per cent of its total population living in cities in 2018.[128] The region's cities and municipal governments are key players in the circular economy transition. Most cities face major challenges in dealing with municipal solid waste. The amount of waste generated in the region is expected to increase from 541,000 tonnes/day in 2014 to 670,000 tonnes/day by 2050.[129] Currently, all countries in the region rely overwhelmingly on the use of land fill or illegal dumping as their main methods of final disposal. One important objective of circular economy transitions for cities across the LAC region should be to reduce the pollution burden of the urban poor – in particular, to support communities impacted by mismanaged waste.

In the LAC region, over 35,000 tonnes of waste is left uncollected every day, impacting over 40 million people – about 7 per cent of the population.

In the LAC region, over 35,000 tonnes of waste is left uncollected every day, impacting over 40 million people – about 7 per cent of the population – particularly those living in marginal areas, such as slums and informal settlements, and some rural areas. Recycling rates in LAC are still low – around 1–20 per cent – while approximately 90 per cent of municipal waste is either dumped or burned.[130] Most recycling efforts in LAC countries focus on the high numbers of waste polyethylene terephthalate (PET) bottles generated in cities. There are many unofficial waste pickers who collect and separate this recyclable plastic material. However, even PET bottle recycling rates are low. In Brazil, only about 50 per cent of this material is recycled after use and about 17 per cent is mismanaged – dumped or openly burned; in Mexico, mismanagement accounts for at least 20 per cent of all PET bottles collected.[131] While final disposal of waste has improved over the last decade, this will continue to be a challenge as the amount of waste generated increases, from 541,000 tonnes per day in 2014, to a projected 671,000 tonnes per day in 2050.[132]

Due to the COVID-19 pandemic, the collection of recyclables was interrupted in most cities and countries of the region and recycling rates have dropped. On the upside, big urban centers have seen a decrease in the volume of waste generated, in some cases significant reductions, for example, in the cases of Buenos Aires and Bogota the decrease is estimated to be about 34 per cent and 25 per cent, respectively.[133] This is due to quarantine measures and the reduced number

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128 UN Population Division (2018), 'Urban population (% of total population) – Latin America & Caribbean', Washington, DC: World Bank Group, https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=ZJ&name_desc=false (accessed 18 Jun. 2020).
129 United Nations Environment Programme (2018), *Waste Management Outlook for Latin America and the Caribbean*, https://wedocs.unep.org/handle/20.500.11822/26448 (accessed 3 Aug. 2020).
130 UN Environment Programme (2018), *Waste Management Outlook for Latin America and the Caribbean*.
131 Gower, R., Green, J. and Williams, M. (2020), *The Burning Question: Will Companies Reduce Their Plastic Use?,* Teddington, UK: Tearfund, https://learn.tearfund.org/~/media/files/tilz/circular_economy/2020-tearfund-the-burning-question-en.pdf (accessed 25 May 2020).
132 UN Population Division (2018), 'Urban population (% of total population) – Latin America & Caribbean'.
133 ISWA (2020), *COVID-19 Update: Latin America*, International Solid Waste Association, https://www.iswa.org/iswa/covid-19/covid-19-news/covid-19-news-detail/article/covid-19-update-latin-america/1628/ (accessed 4 Aug. 2020).

of people commuting to cities. These experiences offer an opportunity to turn around the previous growth in waste generation and re-design waste management systems in the post-COVID-19 recovery.

Sanitation, wastewater management and sewage sludge treatment are further challenges faced by cities across the region. About 490 million people – some 69 per cent of the region's population, according to a 2019 report by the Inter-American Development Bank (IADB) – lack proper sanitation, and only about 20 per cent of industrial and residential wastewater is treated before being discharged.[134] Especially in many small and medium-sized cities in the region, wastewater rarely goes through an adequate treatment process before being discharged, often into rivers and lakes. Adopting circular economy principles for the processing of wastewater to recover and reuse resources can transform sanitation from a costly service, in terms of public finance, to one that is self-sustaining and adds value to the economy.[135] For example, the circular economy includes sustainable options for utilizing sewage sludge to generate energy and biosolids, and can address the problem of sludge management in the LAC region. Sludge has a high nutrient content and can be used to create safe forms of fertilizer through the use of anaerobic digesters and drying beds for composting. Fertilizers and recovered phosphorus can be employed to increase yields of agricultural crops.[136]

Box 8. Circular economy initiatives in major cities in LAC

Given the fragmented nature of waste management in LAC countries,[137] several cities have launched their own circular economy plans, with the particular objective of tackling waste. For example, in 2019, the Mexico City municipal government announced an Action Plan for a Circular Economy, which aims to achieve zero waste through a range of strategic priorities: regulations to reduce the amount of packaging and the manufacture of single-use products; proper waste management processes and infrastructure; the creation of cooperatives and microenterprises specializing in waste management; and running zero-waste education campaigns.[138] The Action Plan received an initial investment of 300 million pesos ($14 million).

In the Argentinian capital of Buenos Aires, the voluntary 'Buenos Aires Produce más Limpio' (Buenos Aires Produces Cleaner) scheme, launched in 2011, has encouraged cooperation between businesses and the city government and provides training to promote the uptake of technologies, processes, products and services that integrate environmental protection

134 Inter-American Development Bank (2019), 'How is Latin America in terms of sanitation?', August 2019, https://www.iadb.org/en/improvinglives/how-latin-america-terms-sanitation (accessed 9 Mar. 2020).
135 Rodriguez, J. D., Serrano, H., Delgado, A., Nolasco, D. and Gustavo, S. (2020), *From Waste to Resource: Shifting paradigms for smarter wastewater interventions in Latin America and the Caribbean*, International Bank for Reconstruction and Development/The World Bank Group, https://www.worldbank.org/en/topic/water/publication/wastewater-initiative (accessed 18 Jun. 2020).
136 Ferrans, L., Avellán, T., Muller, A., Hettiarachchi, H., Dornack, C. and Caucci, S. (2020), 'Selecting sustainable sewage sludge reuse options through a systematic assessment framework: Methodology and case study in Latin America', *Journal of Cleaner Production,* 242, 118389: pp. 1–12, doi:10.1016/j.jclepro.2019.118389.
137 Savino, A., Solórzano, G., Quispe, C. and Correal, M. C. (2018), *Waste Management Outlook for Latin America and the Caribbean*, UNEP, https://wedocs.unep.org/bitstream/handle/20.500.11822/26448/Residuos_LAC_EN.pdf?sequence=2&isAllowed=y (accessed 18 Jun. 2020).
138 Residuos Profesional (2019), 'Ciudad de México Presenta su Plan de Acción Para una Economía Circular' [The City of Mexico presents it's Circular Economy Action Plan], 31 May 2019, https://www.residuosprofesional.com/ciudad-de-mexico-plan-economia-circular/ (accessed 23 Aug. 2019); Michell, N. (2013), 'How Mexico City has Turned Garbage into Fuel', Cities Today, 18 January 2013, https://cities-today.com/how-mexico-city-has-turned-garbage-into-fuel/ (accessed 23 Aug. 2019).

with economic and social development.[139] Buenos Aires also launched a 'Green City' (Ciudad Verde) Plan in 2012, which established a base salary and formal working conditions for waste pickers. While this was successful in providing a basic income and benefits, it did not extend to all waste pickers. However, continued issues with waste management and the failure to meet zero-waste targets have led to new proposals to privatize the waste system in the city, causing concern about whether a privatized system will afford the same benefits to waste pickers. Similarly, the incineration of waste, which was banned under the city's Zero Waste Law of 2005, is now permitted under reforms of the law in 2018.[140]

Other cities that have also introduced strategies based on the zero-waste principle include the Ecuadorian capital of Quito, which has developed a Master Plan for Comprehensive Waste Management, covering the period 2015–25.[141] This followed previous initiatives in the capital, such as Quito a Reciclar (Quito Recycles), introduced in 2012.

Beyond waste management, the circular economy offers new potential for cities in the region to apply innovative urban agriculture, as well as more sustainable food production, construction and transportation systems. Examples from Manizales, in Colombia, and São Carlos, in Brazil, show that building integrated rooftop greenhouses, which exchange energy, collect rainwater and use organic waste for compost, can optimize both the energy efficiency of buildings and contribute to local food production.[142] In the Cuban capital of Havana, the 'organoponics' system of urban agriculture – where food is grown using an organic substrate obtained from crop, animal and household waste – demonstrates how space and production can be optimized by growing food on building sites, vacant lots and roadsides, and in plots arranged in terraces on sloping land.[143]

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139 Buenos Aires Ciudad (n.d.), 'producción sustentable' [Sustainable Production], https://www.buenosaires.gob.ar/areas/med_ambiente/apra/des_sust/prod_sust/prog_esp_ba_pml.php?menu_id=32356 (accessed 17 Jun. 2020).
140 Buenos Aires Ciudad (n.d.), 'Hacia una economía circular, La vida útil de los productos que consumimos, no siempre termina cuando nosotros creemos' [Towards a Circular Economy, the lifetime of the products we consume doesn't always end when we think], https://www.buenosaires.gob.ar/agenciaambiental/programa-produce-mas-limpio/hacia-una-economia-circular (accessed 22 Jun. 2020); Balch, O. (2016), 'The new generation of Buenos Aires trash pickers reenergizing recycling in the capital', *Guardian,* 20 January 2016, https://www.theguardian.com/environment/2016/jan/20/buenos-aires-litter-pickers-cartoneros-recycling-argentina-environment (accessed 22 Jun. 2020); GAIA (2018), 'GAIA Rejects Dangerous Reform of Buenos Aires Zero Waste Law', 4 May 2018, https://www.no-burn.org/gaia-rejects-brutal-reform-of-buenos-aires-zero-waste-law/ (accessed 22 Jun. 2020); Schröder, Anantharaman, Anggraeni and Foxon (eds) (2019), *The Circular Economy and the Global South: Sustainable Lifestyles and Green Industrial Development*; Telam (2016), 'Los cartoneros porteños denunciaron la privatización del sistema de reciclado' [Buenos Aires' waste pickers denounce the privatization of the recycling system], 14 July 2016, https://www.telam.com.ar/notas/201607/155255-cooperativas-cartoneros-ciudad-reclamo-privatizacion.php (accessed 23 Jun. 2020).
141 *Itransporte* (2016), 'Ma Verónica Arias/Environmental Department of Quito', October 2016, https://www.revistaitransporte.com/ma-veronica-arias-cabanillas-environmental-department-of-quito/ (accessed 23 Aug. 2019); Travel 2Latam (2016), 'Quito figura entre las ciudades más sustentables del mundo' [Quito is one of the most sustainable cities in the world], 18 July 2016, https://es.travel2latam.com/nota/4230/quito_figura_entre_las_ciudades_mas_sustentables_del_mundo/ (accessed 23 Aug. 2019); CAF Development Bank of Latin America (2016), 'Quito develops new waste management plan with the support of CAF', 6 July 2016, https://www.caf.com/en/currently/news/2016/07/quito-develops-new-waste-management-plan-with-the-support-of-caf/ (accessed 23 Aug. 2019); Sanchez, M., Real, E. and Del Campo, J. (2016), 'Zero Waste', *Itransporte,* October 2016, https://www.revistaitransporte.com/zero-waste/(accessed 23 Aug. 2019).
142 Sanyé-Mengual, E. et al. (2018), 'Urban horticulture in retail parks: Environmental assessment of the potential implementation of rooftop greenhouses in European and South American cities', *Journal of Cleaner Production*, 172: pp. 3081–91, doi:10.1016/j.jclepro.2017.11.103 (accessed 12 Jun. 2020).
143 FAO (2014), *Growing Greener Cities in Latin America and the Caribbean*, Rome: Food and Agriculture Organization of the UN, http://www.fao.org/3/a-i3696e.pdf (accessed 17 Jun. 2020).

Industry 4.0 and the Internet of Things (IoT) are set to play a significant role in revolutionizing waste management. Semi-driverless collection vehicles and sensors are already used in waste collection systems. With the applications of robotics and AI, future waste treatment plants will be highly optimized facilities where no human will be in direct contact with waste. Almost all recyclables will be recovered and valorized. As with automation in other sectors, it will change the role of labour and job losses can be expected, especially for routine manual occupations, transport workers and operators.[144]

A just transition approach is particularly important to address social justice concerns surrounding waste management systems in current use across the region. At present, the informal sector plays a key role in municipal waste collection in many of its cities. The integration of waste pickers as partners in waste management schemes is considered key to building just, inclusive and liveable cities in the LAC region.[145] However, as countries and cities seek to modernize their waste management and recycling processes, this group risks being marginalized.[146] Respondents to the Chatham House survey highlighted the need for the inclusion of informal workers in the waste management sector as a priority for a just transition in the region. The extent to which such inclusion is successful will determine whether the informal sector stands to win or lose from the transition to a circular economy.

The term 'waste picker' was adopted at the First World Conference of Waste Pickers, held in Bogotá in 2008, and in 2013, the mayor of that city introduced a formal payment system for waste pickers in exchange for their services in collecting and transporting recyclable materials.[147] Some countries, like Chile and Brazil, have made efforts to include informal waste pickers in new waste management systems. International development cooperation also supports the inclusion of informal sector workers. An example is the EcoVecindarios (Eco-communities) project (2009–18),[148] led by the Bolivian branch of the Swiss Foundation for Technical Cooperation (Swisscontact). The project supported the inclusion of waste pickers into the solid waste management system of the city of Cochabamba, subsequently being extended to the cities of El Alto, La Paz, Santa Cruz and other municipalities.

In addition to an inclusive approach towards waste picker communities, other success factors for a just transition will include the remediation of existing open dumping sites, support for affected communities, and behaviour change campaigns. Proper segregation at source is also key to the success of many waste valorization programmes; many countries in the region have already implemented separate collection programmes for different types of waste for this precise reason.[149]

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144 ISWA (2019), *How Industry 4.0 transforms the waste sector*, International Solid Waste Association, https://www.iswa.org/home/news/news-detail/article/iswa-president-launches-ground-breaking-new-report-preparing-the-waste-management-industry-for-the-4/109/ (accessed 22 Jun. 2020)
145 Dias, S. M. (2016), 'Waste pickers and cities', *Environment and Urbanization,* International Institute for Environment and Development (IIED), 28(2): pp. 375–90, doi:10.1177/0956247816657302 (accessed 15 Jun. 2020).
146 Schröder, Anantharaman, Anggraeni and Foxon (eds) (2019), *The Circular Economy and the Global South: Sustainable Lifestyles and Green Industrial Development*.
147 WIEGO (n.d.), 'Bogota Recycler Nohra Padilla Praised on World Stage', https://www.wiego.org/informal-economy/worker-stories/bogota-recycler-nohra-padilla-praised-world-stage (accessed 22 Jun. 2020).
148 BEAM Exchange (2019), 'Programme profile EcoVecindarios (Eco-communities)', https://beamexchange.org/practice/programme-index/230/(accessed 16 Jun. 2020).
149 UN Environment Programme (2018), *Waste Management Outlook for Latin America and the Caribbean*.

The bioeconomy – circular principles to ensure sustainability

Although the bioeconomy is a rather new term and concept, many countries across the region have adopted bioeconomy principles in the last two decades in a range of sectors, with different degrees of socio-economic and environmental impact. The bioeconomy offers many opportunities for countries in LAC, especially in the food and agricultural sector, but it also creates challenges. Opportunities arise because of the region's broad biodiversity, genetic resources, diverse productive landscapes, and capacity to produce food and biomass.[150] This is a commonly held view among respondents to the Chatham House survey, almost half of whom indicated that the food and agricultural sector will be among those to benefit most from the circular economy transition in the region. The main difficulty is in developing a sustainable bioeconomy that ensures protection of ecosystems and finds new pathways for more inclusive and equitable rural development.

The EU's definition of the bioeconomy is as follows:

> The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste). It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services.[151]

So far, unlike in the EU, there is no consensus across LAC countries on a definition – or an agreed regional vision that could serve as a reference framework to guide the development of national policies and strategies. According to ECLAC, consensus on the bioeconomy in LAC could be built on the following 'four pillars':

1. Promote sustainable development, taking Agenda 2030 as a frame of reference;
2. Promote climate action, taking as a frame of reference the Paris Agreement and the proposals of the countries in their nationally determined contributions (NDCs);
3. Promote social inclusion (e.g. family farming, youth and women, indigenous peoples) and the reduction of territorial development gaps within countries; and
4. Promote innovation processes that contribute to the diversification of economies and generate new value chains, especially those that contribute to regional development, are in high-growth market segments, or offer opportunities to young people and women.[152]

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150 Inter-American Institute for Cooperation on Agriculture (2019), 'The Outlook for Agriculture and Rural Development in the Americas: A Perspective on Latin America and the Caribbean 2019–2020', ECLAC/FAO/IICA, San Jose, Costa Rica: IICA, https://repositorio.iica.int/bitstream/handle/11324/8214/BVE19040295i.pdf;jsessionid=4216DB9CBE7BFB55F099605FE412A9D9?sequence=2 (accessed 18 May 2020).
151 European Commission (2018), *A sustainable Bioeconomy for Europe: strengthening the connection between economy, society and the environment – Updated Bioeconomy Strategy*, European Commission, Directorate-General for Research and Innovation, https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf (accessed 22 Mar. 2020).
152 Rodríguez, A., Rodrigues, M. and Sotomayor, O. (2019), *Towards a sustainable bioeconomy in Latin America and the Caribbean: Elements for a regional vision*, Natural Resources and Development series, No. 193 (LC/TS.2019/25), https://repositorio.cepal.org/bitstream/handle/11362/44994/1/S1901014_en.pdf.

Several countries in the region are taking a proactive stance on developing national bioeconomy plans and strategies. In 2016, Argentina launched its bioeconomy strategy document,[153] and in 2018 the Argentinian government co-signed a letter of intent with the Inter-American Institute for Cooperation on Agriculture, which paved the way for the country to become a regional bioeconomy knowledge hub.[154] In Ecuador, the bioeconomy is included in the national development plan and the Ecuadorian government is currently developing a national bioeconomy policy.[155] Colombia has launched several strategies related to the bioeconomy since 2002, when it launched its National Plan on Continental and Marine Bioprospecting;[156] the issue constitutes a core theme of Uruguay's 2050 development strategy[157] and Costa Rica's National Decarbonization Plan for green economic development.[158]

Forests accounted for about 46 per cent of the region's total land area in 2015 and the region is home to 57 per cent of the world's primary forests, which are the most important forest resources in terms of biodiversity, conservation and climate.

Forest resources and biodiversity are crucial for the bioeconomy. Of the world's 17 'mega diverse' countries (as identified by the US non-governmental organization Conservation International in 1998), six are located in the LAC region: Brazil, Colombia, Ecuador, Mexico, Peru and Venezuela.[159] Forests accounted for about 46 per cent of the region's total land area in 2015[160] and the region is home to 57 per cent of the world's primary forests, which are the most important forest resources in terms of biodiversity, conservation and climate.[161] With its diversity and abundance of natural resources, the region has great potential to further develop its bioeconomy. Areas of focus in the past two decades include the

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153 Ministerio de Agroindustria (2016), Bioeconomía Argentina Visión desde Agroindustria [Agroindustry's vision of the Argentinian Bioeconomy], https://magyp.gob.ar/sitio/areas/bioeconomia/_archivos//000000_Bioeconomia%20Argentina.pdf (accessed 4 Aug. 2020).
154 News784 (2018), 'Argentina set to become hub in the field of bioeconomy', 20 November 2018, https://news784.com/world/argentina-set-to-become-hub-in-the-field-of-bioeconomy/(accessed 25 Nov. 2019).
155 Mata, M. (2018), 'Comunicado', Gobierno del Ecuador, Ministerio del Ambiente, press release, http://www.ambiente.gob.ec/comunicado-12/ (accessed 25 Nov. 2019); Gobierno del Ecuador, Ministerio del Ambiente (n.d.), '5 Retos, 3 Oportunidades y 1 Senda de Desarrollo..La Bioeconomía' [5 Challenges, 3 Opportunities and one pathway for development… The Bioeconomy], http://www.inteligenciaproductiva.gob.ec/imagenes/foro-documentos/Bioeconomia_MAE.pdf (accessed 16 Jun. 2020).
156 German Bioeconomy Council (2015), Synopsis of National Strategies around the World, https://biooekonomierat.de/fileadmin/international/Bioeconomy-Policy_Part-II.pdf (accessed 25 Nov. 2019).
157 Presidencia de la República Oriental del Uruguay, Oficina de Planeamento y Presepuesto (2019), *Aportes para una Estrategia de Desarrollo 2050 [Contributions towards the 2050 Development Strategy]*, pp. 53, 170.
158 Government of Costa Rica (2018), 'National Decarbonization Plan 2018–2050', https://cambioclimatico.go.cr/wp-content/uploads/2020/01/NationalDecarbonizationPlan.pdf (accessed 17 Jun. 2020).
159 Kumar, V. (2018), '17 Megadiverse Countries in the World', RankRed, 22 December 2018, https://www.rankred.com/top-10-megadiverse-countries-in-the-world/ (accessed 25 Nov. 2019).
160 FAO (2018), *The State of the World's Forests 2018*, Rome: Food and Agriculture Organization of the UN, http://www.fao.org/documents/card/en/c/I9535EN/ (accessed 17 Jul. 2020).
161 FAO (n.d.), 'Sustainable forest management in Latin America and the Caribbean', http://www.fao.org/americas/prioridades/bosques/en/.

valorization of biodiversity resources in medicine and pharmaceuticals, ecological intensification of agriculture, biotechnology applications in sectors such as mining, food and beverage production, bio-refineries and ecosystem services.[162]

However, the bioeconomy is not sustainable by definition. In many bioeconomy strategies, biodiversity is seen as a resource, at the same time, however, there is an urgent need to halt and reverse biodiversity loss in the LAC region.[163] Observers are concerned about large-scale bioenergy production competing with food production for space, with potentially serious consequences for food security and land degradation.[164] Bio-based plastics represent another case in point. Bioplastics are not necessarily sustainable: there is little regulation of their manufacture, and there are multiple resource-intensive factors involved in production, including energy and water inputs. In addition, the current infrastructure does not create the necessary conditions for these bioplastics to break down. Promoting bioplastic production and consumption is therefore not a cost-effective strategy for climate change mitigation, if production is based on conventional feedstock, due to greenhouse gas emissions as a result of direct and indirect land-use change.[165]

While the LAC region should be able to develop its bioeconomy, this should not jeopardize its contributions to the region's food security and biodiversity protection targets. Introducing circular economy principles into the bioeconomy can support the balancing of competing objectives, especially in the context of the SDGs. Circularity principles need to be a key element in achieving such convergence, not only for environmental reasons, but also on economic grounds.[166] The alignment of circular economy and bioeconomy principles can improve resource and eco-efficiency, lowering greenhouse gas footprints and furthering the valorization of waste and production side streams.[167] Examples of valorization include the utilization of organic waste streams from the agriculture, forestry, fishery, aquaculture, food and feed sectors. Furthermore, biodegradable products (e.g. natural fibres) can be safely returned to the nutrient cycle.

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162 Sassona, A. and Malpica, C. (2018), 'Bioeconomy in Latin America', *New Biotechnology,* 40: A, pp. 40–5, doi:10.1016/j.nbt.2017.07.007 (accessed 16 May 2020).
163 UN Environment Programme (2016), *The State of Biodiversity in Latin America and the Caribbean*, UNEP. https://www.cbd.int/gbo/gbo4/outlook-grulac-en.pdf (accessed 26 May 2020).
164 Shukla, P. R., Skea, J., Slade, R., van Diemen, R., Haughey, E., Malley, J., Pathak, M. and Portugal Pereira, J. (eds) (2019), 'Technical Summary', in IPCC, *Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, https://www.ipcc.ch/site/assets/uploads/sites/4/2019/11/03_Technical-Summary-TS.pdf (accessed 4 Aug. 2020).
165 Escobar, N., Haddad, S., Börner, J. and Britz, W. (2018), 'Land use mediated GHG emissions and spillovers from increased consumption of bioplastics', *Environmental Research Letters,* 13(12): 125005, https://iopscience.iop.org/article/10.1088/1748-9326/aaeafb/meta (accessed 17 Jun. 2020).
166 Rodríguez, Rodrigues and Sotomayor (2019), *Towards a sustainable bioeconomy in Latin America and the Caribbean: Elements for a regional vision*.
167 Carus, M. and Dammer, L. (2018), *The 'Circular Bioeconomy' – Concepts, Opportunities and Limitations*, nova paper #9, Huerth, Germany: nova-Institut GmbH, https://ec.europa.eu/knowledge4policy/publication/circular-bioeconomy-concepts-opportunities-limitations_en (accessed 4 Aug. 2020).

Box 9. The use of biomass resources in the bioeconomy

In LAC countries, biomass is a limited resource and in high demand in the bioeconomy. Therefore, it must be used in the most efficient way possible.[168]

Cascading the use of inputs from biomass and natural resources is an existing approach, aimed at maximizing the efficiency of biomass utilization, which strongly overlaps with the circular economy concept.[169] There are three ways to cascade the use of biomass by time, value, and function.[170] Cascading in time refers to the sequential use of biomass. Cascading in value prioritizes the highest value-added and most resource-efficient products. For example, bio-based products and industrial materials would be prioritized over bioenergy under this approach. Cascading in function optimizes production by creating different functional streams from one initial biomass stream (see Figure 1).

An example is provided by the multi-stage cascading use of wood resources, where wood is processed into a high-value product, such as furniture, which is subsequently used at least once (and ideally several times) in material form before disposal or recovery for energy purposes.[171] Cascading biomass use reduces competition for biomass resources between different manufacturing sectors. As the raw materials are being used more efficiently, there is less pressure on forest ecosystems and on land use. To reach agreements among stakeholders – industry, indigenous peoples, local communities and consumers – about volumes and sequences of biomass use, it is important to ensure inclusive and effective involvement processes.

The use of cascading is a central component in the sustainable use of biomass and natural resources. The cascading principle is becoming highly relevant for the efficient use of lignocellulosic biomass (dried plant matter) for the manufacture of high-value products such as advanced fuels and bio-based materials.[172] Industrial biorefineries can increase the variety of products that use biomass, with recent technological advances including the pre-treatment of biomass materials that would previously have been discarded as waste because of the difficulties in processing them.[173]

There is an undoubted opportunity to apply the cascade concept in a way that aligns industrial biorefinery operations with sustainability objectives for forests and biodiversity. The application of cascading methods for both forest residues and crop residues will therefore be important to ensure sustainability of the bioeconomy in the LAC region.

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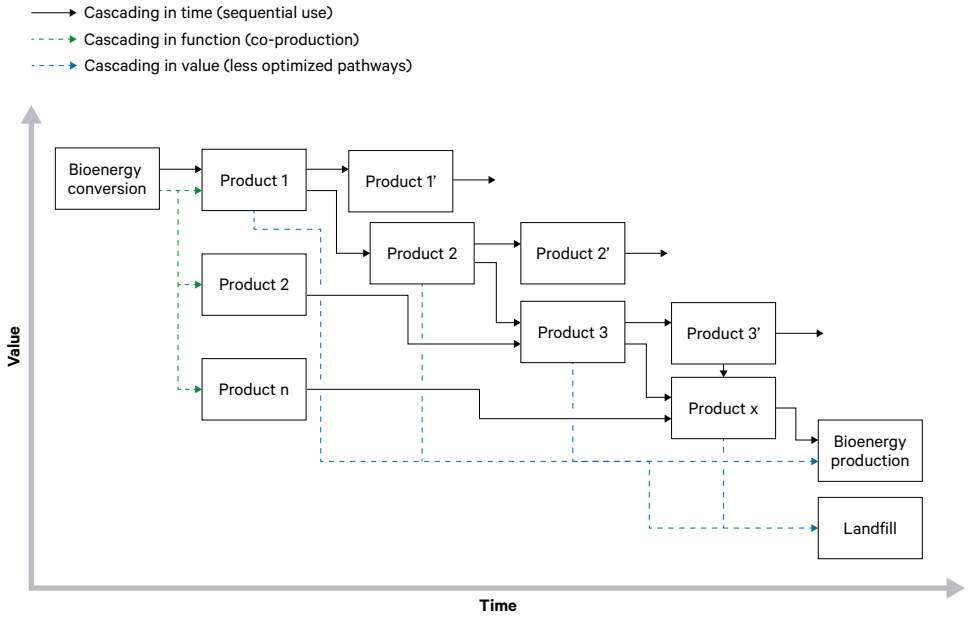
168 Fritsche, U. and Iriarte, L. (2015), 'Bioenergy and technology from a sustainable perspective: Experience from Europe and the global context', in Dallemand, J., Hilbert, J. and Monforti-Ferrario, F. (eds) (2015), Bioenergy and Latin America: A Multi-Country Perspective, Luxembourg: Publications Office of the European Union.
169 Jarre, M., Petit-Boix, A., Priefer, C., Meyer, R. and Leipold, S. (2020), 'Transforming the bio-based sector towards a circular economy – What can we learn from wood cascading?', *Forest Policy and Economics,* 110, 101872, doi:10.1016/j.forpol.2019.01.017 (accessed 15 Jun. 2020).
170 Odegard, I. Croezen, H. and Bergsma, G. (2012), *Cascading of Biomass: 13 Solutions for a Sustainable Bio-based Economy – Making Better Choices for Use of Biomass Residues, By-products and Wastes*, Delft, Netherlands: CE Delft, https://www.cedelft.eu/publicatie/cascading_of_biomass%3Cbr%3E13_solutions_for_a_sustainable_bio-based_economy/1277.
171 Carus and Dammer (2018), *The 'Circular Bioeconomy' – Concepts, Opportunities and Limitations*.
172 Liu, Y. et al. (2019), 'Cascade utilization of lignocellulosic biomass to high-value products', *Green Chemistry,* 21 (13): pp. 3499–535, https://pubs.rsc.org/en/content/articlelanding/2019/gc/c9gc00473d#!divAbstract (accessed 17 Jun. 2020).
173 Pandey, A., Höfer, R., Taherzadeh, M., Nampoothiri, M. andLarroche, C. (2015), *Industrial Biorefineries and White Biotechnology*, Oxford: Elsevier.

Figure 1. Three approaches to biomass cascading



Source: Based on Odegard et al. (2012); Jarre et al. (2020).

From an institutional perspective, a sustainable bioeconomy in LAC depends heavily on the governance of ecosystem services, which requires enhanced coordination and collaboration between different social actors, mediated by ecological functions and management regimes of natural resources.[174] Furthermore, new legal frameworks are needed to regulate the sequence of biomass use, which is particularly challenging if economic or market demand aspects are not aligned with the cascading principles.[175]

Finally, considerations for just transitions in the bioeconomy are closely linked to emerging initiatives that combine the rights of indigenous peoples and forest protection. For example, Peru's NDC includes the country's participation in a REDD+[176] initiative aiming to secure collective land rights for Peru's Amazonian indigenous peoples alongside forest protection, implemented with local governments. In the Amarakaeri Communal Reserve, for example, the Amarakaeri community has protected nearly 1 million acres of forest, and, according to the World Resources Institute, deforestation rates in indigenous-held forestlands are lower than in other forested areas across the country.[177]

174 Muradian, R. and Cardenas, J. (2015), 'From market failures to collective action dilemmas: Reframing environmental governance challenges in Latin America and beyond', *Ecological Economics*, 120: pp. 358–65, doi:10.1016/j.ecolecon.2015.10.001.
175 Carus and Dammer (2018), *The 'Circular Bioeconomy' – Concepts, Opportunities and Limitations*.
176 REDD+: Reducing emissions from deforestation and forest degradation in developing countries. REDD, the forerunner of REDD+, was formally recognized at the 13th UN Climate Change conference (COP 13) in Bali, Indonesia, in 2007. REDD was expanded into REDD+ at COP 14 in Poznań, Poland, in 2008.
177 Bouyé, M., Tankou, A. and Grinspan, D. (2019), 'Growing Momentum for Just Transition: 5 Success Stories and New Commitments to Tackle Inequality Through Climate Action', World Resources Institute, 6 August 2019, https://www.wri.org/blog/2019/08/growing-momentum-just-transition-5-success-stories-and-new-commitments-tackle.

Box 10. The role of food and agriculture systems within the circular bioeconomy

The agricultural and food sector in LAC directly connects the bioeconomy and the circular economy. Moving towards a circular food system requires the implementation of practices and technologies that minimize the input of finite resources, encourage the use of regenerative ones, and prevent the leakage of natural resources such as carbon, nitrogen, phosphorus and water from the food system.[178]

According to the Food and Agriculture Organization of the UN (FAO), roughly one-third of the food that is produced for human consumption (with an estimated value of some $1.3 billion per year) is wasted and thus the resources are lost.[179] While the transition to a circular bioeconomy would entail deploying regenerative agricultural practices, closing nutrient loops, and producing crops with minimum external inputs, it would also require the cessation of overproduction and of food waste. For agri-business worldwide, this could translate into a total income loss of around $750 billion per year.[180] In many LAC countries, the agro-industry sectors – which stand to lose from the circular economy transition related to food and diets – constitute powerful lobbying groups.[181]

More importantly, in Bolivia, Ecuador, Guatemala, Honduras, Nicaragua and Peru, approximately 30 per cent of the population is employed in the agricultural sector,[182] of which a large proportion are small holders. This section of the farming community could potentially experience lower incomes and conflicts over land use as a result of the bioeconomy, if large-scale plantations for the production of energy crops (used solely for combustion) and other bio-based commodities are expanded by agro-businesses, and stimulate land grabbing.[183] Key considerations for a just transition to a circular bioeconomy include prioritizing farmers' access to land, ownership of land and food sovereignty over land use for industrial crops and biomass production.

There is a long tradition in LAC countries of incorporating circularity into food systems, and of adopting agro-ecological systems that promote food sovereignty.[184] However, achieving equitable food and nutrition security within populations will also require international action to create and maintain sustainable food systems. Circular bioeconomy strategies at national and international level, promoting sustainable regenerative agriculture, can help to address these issues faced by food and agriculture systems as other global challenges, from population pressure, climate change and water scarcity, continue to mount.[185]

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178 de Boer, I. and van Ittersum, M. (2018), 'Circularity in agricultural production', Wageningen University & Research, https://www.wur.nl/upload_mm/7/5/5/14119893-7258-45e6-b4d0-e514a8b6316a_Circularity-in-agricultural-production-20122018.pdf (accessed 27 May 2020).
179 FAO (2019), 'SAVE FOOD: Global Initiative on Food Loss and Waste Reduction', http://www.fao.org/save-food/en/ (accessed 15 Aug. 2019).
180 *Economist* (2018), 'Introducing a more circular economy will meet with resistance', 27 September 2018, https://www.economist.com/special-report/2018/09/27/introducing-a-more-circular-economy-will-meet-with-resistance (accessed 17 Aug. 2019).
181 Watts, J. (2018), 'Fears for Amazon as Bolsonaro plans to merge environment and agriculture ministries', *Guardian,* 1 November 2018, https://www.theguardian.com/world/2018/nov/01/bolsonaro-environment-agriculture-ministries-amazon (accessed 4 Dec. 2019).
182 World Bank (2019), 'Employment in agriculture (% of total employment) (modeled ILO estimate), https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS (accessed 26 Nov. 2019).
183 Transnational Institute (2015), *The Bioeconomy: a primer*, TNI, https://www.tni.org/es/node/22481 (accessed 17 Jun. 2020).
184 Altieri, M. and Nicholls, C. (2008), 'Scaling up Agroecological Approaches for Food Sovereignty in Latin America', *Development,* 51: pp. 472–80, doi:10.1057/dev.2008.68 (accessed 17 Jun. 2020).
185 Fears, R., ter Meulen, V. and von Braun, J. (2019), 'Global food and nutrition security needs more and new science', *Science Advances*, 5(12): eaba2946, doi: https://advances.sciencemag.org/content/5/12/eaba2946 (accessed 17 Jun. 2020).

Table 1. Sector opportunities and challenges of the circular economy in LAC

Sector	Opportunities	Challenges
Extractives and mining	• To address environmental and social risks from mining activities and to valorize tailings; • Rising demand for key materials used in low-carbon technologies; • New technology development and automation of mining operations.	• Significant environmental and social impacts from mining operations; • Strong reliance of national economies on extractive sectors and resource exports; • Fast development of 'urban mining' business models that compete with traditional mining businesses.
Municipal waste management and recycling	• To create further cooperative models that include the informal sector in waste management and recycling; • Applying circular economy principles to wastewater treatment (water recycling for irrigation, biogas, etc.); • Use of Industry 4.0 technologies to improve collection and resource recovery (e.g. automated collection and sorting).	• High volumes of municipal waste currently untreated or discarded in landfills; • Very low recycling rates and lack of markets for recycled materials; • High level of informality in the sorting and recycling sector; • Rising trend of increased per capita waste generation due to changing consumption patterns.
Circular bioeconomy	• Biodiversity rich ecosystems can be used as new resources for sustainable bio-products; • Application of cascading principles to ensure efficient use of biomass resources; • Controlling and reversing deforestation.	• Managing trade-offs in competing interests for biomass resources; • Ensuring balance between sustainable use of biomass and protecting ecosystems and biodiversity; • Shifts from large-scale agriculture to sustainable food systems.

Source: Compiled by the authors.

04
Financing the circular economy transition in LAC

The circular economy transition requires significant investment. While this may start with national and local government financing, the private sector and multilateral agencies also have roles to play.

The transition to a circular economy in the LAC region requires significant investments in infrastructure – in particular, in waste collection, management and recycling. The IADB estimates that annual infrastructure investment of $250 billion is needed across the region over the next few years, and that an additional $30 billion per year will be required to introduce measures that will bring countries' processes in line with the SDGs and the objectives of the Paris Agreement.[186] For example, to address the challenge of providing sustainable and safe sanitation for all in the LAC region, the IADB has estimated that annual investments of about $180 million would be needed each year until 2030.[187] Although there are no accurate figures available at present regarding investment needs in the solid waste management and recycling sector for the different countries in the LAC region, addressing the existing challenges will require the use of resources from both national and local governments, and private-sector participation, as well as requesting loans and technical cooperation from multilateral agencies.[188]

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186 Reymond, A., Egler, H.-P., Masullo, D. and Pimentel, G. (2020), *Financing sustainable infrastructure in Latin America and the Caribbean,* Inter-American Development Bank, March 2020, https://publications.iadb.org/publications/english/document/Financing-Sustainable-Infrastructure-in-Latin-America-and-the-Caribbean-Market-Development-and-Recommendations.pdf (accessed 18 May 2020).
187 Inter-American Development Bank (2019), 'How is Latin America in terms of sanitation?'.
188 UN Environment Programme (2018), *Waste Management Outlook for Latin America and the Caribbean*.

Development finance institutions and the Global Environment Facility

Circular economy projects funded by the World Bank and the CAF Development Bank of Latin America tend to focus on funding waste management programmes in countries such as Argentina, Brazil and Colombia. In 2018 the World Bank launched a new initiative, the 'Wastewater: From Waste to Resource' project, which focused on raising awareness among decision-makers across the LAC region regarding the potential of wastewater as a resource and aimed to introduce circular economy principles in wastewater management. More specifically, the initiative had the purpose of encouraging 'a paradigm shift' in the sanitation sector 'in which the value proposition of wastewater in a circular economy is recognized'.[189]

The IADB is a leading source of long-term financing for economic, social and institutional projects in the LAC region. Through its own Multilateral Investment Fund and other sources, the IADB has provided finance for a range of different projects linked to the circular economy in Brazil, Chile and Uruguay, as well as across the Caribbean. The IADB, together with MIT Solve (an initiative of the Massachusetts Institute of Technology that describes itself as 'a marketplace for social impact innovation')[190] has also developed an initiative to find the most innovative solution to substantially reduce or eliminate single-use plastic and plastic waste in the region, with prizes totalling some $60,000 on offer.[191]

The circular economy has been recognized by the GEF as a unique opportunity to pursue a suite of environmental benefits through public–private partnerships.

The circular economy has been recognized by the GEF as a unique opportunity to pursue a suite of environmental benefits through public–private partnerships. The circular economy is highlighted under the broad GEF-7 strategy, within two distinct focal areas – international waters, and chemicals and waste – as well as within the Sustainable Cities Impact Program. GEF-7 investments focus on actions that can lead to a shift in global supply chains and by regional and national economic development strategies from 'take–make–throw away' to 'redesign–reduce–reuse–repair–recycle' approaches. Under its Small Grants Program,[192] the GEF has funded a number of projects that have tested innovative practices for plastic waste

189 Rodriguez, Serrano, Delgado, Nolasco and Gustavo (2020), *From Waste to Resource: Shifting paradigms for smarter wastewater interventions in Latin America and the Caribbean*.
190 Massachusetts Institute of Technology (MIT) (2020), Solve, https://solve.mit.edu/ (accessed 29 Jul. 2020).
191 Inter-American Development Bank (2019), 'IDB Group Launches Open Innovation Challenge to reduce plastic use', news release, 26 September 2019, https://www.iadb.org/en/news/idb-group-launches-open-innovation-challenge-reduce-plastic-use (accessed 18 Oct. 2019).
192 Global Environment Facility Small Grants Programme (2019), 'Project Search Results', https://www.sgp.undp.org/spacial-itemid-projects-landing-page/spacial-itemid-project-search-results.html?view=allprojects (accessed 18 Oct. 2019).

management in the LAC region using a circular economy approach. Examples of projects include promoting the recycling of plastic waste and addressing the disposal of PET plastics in countries such as Guyana, Peru and Suriname.

KfW Development Bank has been financing circular solutions to wastewater management in Bolivia, Nicaragua and Peru. In Nicaragua, KfW-financed sewage treatment plants have developed a new solution to dispose of sewage sludge through the addition of a solar facility that dries out the sludge at the treatment plant. The resultant granulate is rich in nitrates and phosphates and can be used for as a fertilizer or to improve soil quality.[193] In the Peruvian capital of Lima, which is located on desert land, a treatment and recycling plant for industrial wastewater processes water so that it can be used to water the city's parks and green areas. This solution bypasses the drinking water network, which was used in the past for watering the city's green areas.[194]

Government-funded circular economy initiatives in LAC

Across the region, there are considerable differences in government support for circular economy projects. This has a direct impact on the availability of funding from national and commercial banks. Examples are given below for the types of support available within four major economies.

The Chilean Ministry of the Environment, in conjunction with the national economic development agency CORFO, provides financial support to circular economy activities in Chile, for example, through the creation of technology development centres in the country. In 2018, CORFO launched the programme Prototipos de Innovación en Economía Circular (Innovation Prototypes in the Circular Economy) in conjunction with the Ministry of the Environment and the Ministry of the Economy and Development.[195] The programme was open to Chilean companies and self-employed entrepreneurs for at least one year, with co-financing of up to 60 million pesos being made available for eligible projects. The funding can be used to carry out activities aimed at designing and developing circular economy prototypes. The percentage of co-financing depends on the size of the company: large companies can obtain financing for up to 30 per cent of the total project cost, while medium-sized companies can obtain 50 per cent.[196]

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193 KfW Development Bank (2016), *Project Information, Water – Nicaragua*, https://www.kfw-entwicklungsbank.de/PDF/Entwicklungsfinanzierung/L%C3%A4nder-und-Programme/Lateinamerika-Karibik/Projekt-Nicaragua-Wasser-2014-EN.pdf.
194 KfW Development Bank (2016), *Project Information, Water – Peru*, https://www.kfw-entwicklungsbank.de/PDF/Entwicklungsfinanzierung/L%C3%A4nder-und-Programme/Lateinamerika-Karibik/Projekt-Peru-Wasser-2014.pdf.
195 Gobierno de Chile (2018), 'Lanzan programa de innovación en economía circular pionero en América Latina', 9 August 2018, https://www.gob.cl/noticias/lanzan-programa-de-innovacion-en-economia-circular-pionero-en-america-latina/ (accessed 22 Aug. 2019).
196 Corporación de Fomento de la Producción (CORFO) (2019), 'Strategic Investment Incentives', https://www.corfo.cl/sites/cpp/movil/webingles (accessed 17 Oct. 2019).

In Uruguay, the national development agency ANDE has spearheaded a Circular Economy Opportunities Programme (Oportunidades Circulares).[197] In the first round, in 2019, one component of the programme provided funding for the validation process that would test circular economy ideas (up to $5,000) and a second component focused on project implementation, with co-funding of up to $100,000. For the second round, financial support was added with non-reimbursable funds for the realization of prototyping (up to a maximum of $40,000 per project). In the first round, the projects that were submitted mainly focused on waste recycling, demonstrating a general lack of understanding of the broader circular economy principles. The inclusion of prototype financing in the second round facilitated the entry of Industry 4.0 technologies and promoted a greater hierarchization of circular economy elements.

In Peru and Colombia, the Swiss State Secretariat for Economic Affairs (SECO) supported a 'green credit line' for cleaner technology implementation in small and medium-sized enterprises (SMEs). In the case of Peru, a reimbursement of up to 25 per cent of the loan was offered as an incentive to would-be borrowers. After verifying the proper implementation of cleaner technology, and the expected reduction in environmental impact (according to a predefined environmental indicator), the reimbursement was transferred to the bank and the SME could reduce either the monthly payment amounts or the period of the loan. The green credit line was operated through two commercial banks (Banco de Crédito del Perú and Scotiabank Perú Canada) with technical assistance from the national cleaner production centre operated by Grupo GEA. Fifty SMEs participated in the green credit line, accounting for $21 million of credits made available in the sectors of metalworking, tanneries, food, brick manufacture, paper and packaging, among others.[198]

Table 2. Overview of circular economy finance schemes in LAC

Financial institution	Countries	Financial products	Circular economy practices and sectors
World Bank	Argentina, Bolivia, Brazil, Colombia, Peru	Traditional loans, grants, results-based financing	Waste management and recycling; wastewater treatment and resource recovery
Inter-American Development Bank (IADB)	Belize, Bolivia, Brazil, Chile, Suriname, Uruguay	Traditional loans, grants, guarantees	Waste management and recycling; wastewater treatment and resource recovery
Global Environment Facility (GEF)	Guyana, Peru, Suriname, Uruguay	Small grants, small business subsidies	Plastic waste management, PET recycling and waste valorization

197 ANDE and Biovalor (2019), 'ANDE, PAGE Uruguay y Biovalor impulsan la economía circular a través de un programa de fondos y generación de capacidades entorno a la Economía Circular', http://oportunidadescirculares.org (accessed 15 Jul. 2020).
198 UN Industrial Development Organization (2009), *Funding options for Small and Medium Size Enterprises to finance Cleaner Production projects and Environmentally Sound Technology investments*, Vienna: UNIDO, http://www.ioew.at/ioew/download/09-80065_Ebook-UNIDOFundingoptions.pdf.

Financial institution	Countries	Financial products	Circular economy practices and sectors
National Development Agency (ANDE)	Uruguay	Small business subsidies; funds for prototyping, validation of circular economy ideas and project implementation	Recycling, Industry 4.0 technology adoption
Ministry of Environment and CORFO	Chile	State co-financing	Circular economy technology design and prototyping
Swiss State Secretariat for Economic Affairs (SECO)	Colombia, Peru	Green credit lines for SMEs	Cleaner production and waste reduction in manufacturing
KfW Development Bank	Bolivia, Nicaragua, Peru	Federal funds	Wastewater disposal and sewage sludge recycling

Source: Compiled by the authors.

Post-COVID-19 recovery finance

In April 2020, ECLAC predicted that the prevailing COVID-19 pandemic would lead to an estimated 29 million more people in the LAC region living in poverty, and a further 16 million descending into a situation of extreme poverty.[199] ECLAC called for both the forgiving and deferring of debt where necessary, as well as lending at favourable interest rates. In the immediate term, priority must of course be given to dealing with the health crisis and providing support to those with lost incomes. In the medium term, which should coincide with the aftermath of the crisis, the world should take the opportunity to create more resilient production networks, and recalibrate investment into inclusive and sustainable development.[200]

Some LAC countries have already announced inclusive COVID-19 economic recovery funds to support businesses and the unemployed, including informal sector workers. In Chile, the government launched an $11.75 billion stimulus package to boost health spending, allow the deferral of taxes, fund loans to individuals and SMEs, and provide income support to the unemployed.[201] In Brazil, a $150 billion package was announced, including income support, aid for informal workers, loans to SMEs and financial support to states, as well as support to carbon-intensive industries such as airlines.[202]

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199 ECLAC (2020), 'COVID-19 Pandemic Will Lead to the Biggest Contraction in Economic Activity in the Region's History: A -5.3% Drop in 2020', press release, 21 April 2020, https://www.cepal.org/en/pressreleases/covid-19-pandemic-will-lead-biggest-contraction-economic-activity-regions-history-53 (accessed 15 May 2020).
200 OECD (2020), 'COVID-19 in Latin America and the Caribbean: Regional socio-economic implications and policy priorities', 29 April 2020, https://read.oecd-ilibrary.org/view/?ref=129_129904-k3xp17fqbl&title=COVID-19-in-Latin-America-and-the-Caribbean-Regional-socio-economic-implications-and-policy-priorities (accessed 15 May 2020).
201 Thomson, E. and Fuentes, V. (2020), 'Chile Plows Billions Into the Economy as Virus Threat Mounts', Bloomberg, 19 March 2020, https://www.bloomberg.com/news/articles/2020-03-19/chile-s-government-announces-11-75-billion-stimulus-plan (accessed 18 Jun. 2020).
202 KPMG (2020), 'Brazil: Government and institution measures in response to COVID-19', https://home.kpmg/xx/en/home/insights/2020/04/brazil-government-and-institution-measures-in-response-to-covid.html (accessed 18 Jun. 2020).

As COVID-19 recovery funds are extended, they offer an opportunity for LAC governments to support more circular economy activities, in particular via central support to green SMEs and international investment in green industries. China, a major trade and investment partner in the region, has historically invested in many high-carbon mining and oil extraction projects. Given the dramatic fall in oil prices, which has accompanied the pandemic, redirecting investment towards green alternatives could help regional economic recovery, while also reducing emissions. The renewable energy and clean transport sectors have already grown in the LAC region over the past five years, partly thanks to Chinese investments – for example, in the development of the Cauchari solar park in northern Argentina, as part of the Belt and Road Initiative. Indeed, green investments are in alignment with the aims of a white paper published in 2016 by China's Ministry of Foreign Affairs, which restated its commitment to increasing cooperation with LAC countries on the environment and climate change.[203] Continued investment from China, at similar levels, will of course be dependent on China's own economic recovery from the pandemic. However, the region would do well to push for green international investment in the future, both from an environmental and an economic perspective, with the estimated creation of 7.7 million additional jobs if the energy and transport sectors are to become carbon-neutral by 2050.[204]

203 Koop, F. (2020), 'Latin America needs a green stimulus. Will it come from China?', *Diálogo Chino,* 6 May 2020, https://dialogochino.net/en/climate-energy/35184-latin-america-needs-a-green-stimulus-will-it-come-from-china/ (accessed 17 Jul. 2020).
204 UN Environment Programme (2019), 'Latin America and the Caribbean could save US$621 billion by 2050 through the decarbonization of energy, transport sectors', press release, 12 December 2019, https://www.unenvironment.org/news-and-stories/press-release/latin-america-and-caribbean-could-save-us-621-billion-2050-through (accessed 18 May 2020).

05 Potential trade opportunities for the circular economy

The circular economy provides opportunities to improve the balance between local, regional and global trade, but it will take political will and potentially the renegotiation of free-trade agreements to achieve this.

The COVID-19 pandemic has severely impacted LAC supply chains and trade, in terms of both imports and exports. Imports of parts and components required in the electronics, automotive, textiles and pharmaceuticals sectors of Argentina, Brazil and Mexico have been negatively affected by diminished production in China and by disrupted global supply chains. On the other hand, reduced global demand has caused price shocks in key commodities produced by the region, including the sudden plummeting of prices for oil (60 per cent), copper (22 per cent), sugar (20 per cent) and coffee (18 per cent). Such developments have a proportionally greater economic impact for many LAC countries, which rely heavily on exports. The pandemic has also highlighted the key role that China plays as a consumer of LAC-produced commodities: Chinese demand for soya and copper has declined, but it used to absorb 79 per cent of Brazilian soya production and 60 per cent of

Peruvian copper.[205] Overall, it is expected that merchandise trade could decline by between 12 per cent and 31 per cent in 2020 for South and Central American countries, compared to 2019.[206]

It is unlikely that trade relations will bounce back to 'normal' in the post-COVID-19 economic recovery. In addition, value chains are expected to change further during the global transition to a circular economy, as new approaches to create more resilient production and consumption systems are developed. A circular economy perspective on trade can enable a better balance between local, regional and global trade, and boost resilience.

Many countries in the region rely on imported consumer goods produced by the manufacturing sectors of industrialized economies, in particular North America and Asia. After use and consumption, these goods end up in local waste streams, and are mostly landfilled or illegally dumped. Free-trade agreements (FTAs) between LAC states and their trading partners generally have not included clauses about EPR for local waste streams associated with imported goods. To enable more circularity of materials in trade agreements and reduce pressure on local waste management systems, there is a strong case for including EPR policies in existing and new FTAs. Exporting producer countries would be required to take responsibility for end-of-life products in the recipient country. In the case of Panama, studies show that up to 34.5 per cent of valued materials derived from goods imported through FTAs could be exported back to the country of origin, and the amount of waste discarded in landfills could be significantly reduced, if EPR clauses were part of existing FTAs.[207]

The national recycling markets in LAC countries focus mainly on the recovery and recycling of paper, cardboard, scrap metal (ferrous metals), some plastics and glass.

In addition, the LAC region is involved in the trade of various secondary materials, scrap and waste products. The national recycling markets in these countries focus mainly on the recovery and recycling of paper, cardboard, scrap metal (ferrous metals), some plastics (PET and high-density polyethylene – HDPE) and glass. LAC countries are also importers of paper, cardboard and scrap metal, mainly from the US. According to UNEP, in 2013, some 455,000 tonnes of scrap metal were imported from the US by Peru and Ecuador alone. Intra-regional trade in scrap metals was predominantly characterized by exports from Venezuela (which sold 86,000 tonnes to Colombia and Ecuador) and Costa Rica (which sold 25,000 tonnes to Ecuador and Panama). Trade in waste plastics was dominated in 2013 by exports from the region

205 Giordano, P. (2020), '¿Cuán expuesta está América Latina al contagio comercial del coronavirus?' [How exposed is Latin American commerce to coronavirus?], Inter-American Development Bank Blog, 27 March 2020, https://blogs.iadb.org/integracion-comercio/es/america-latina-contagio-comercial-coronavirus/#_ftn2 (accessed 20 Jun. 2020).
206 World Trade Organization (2020), 'Trade set to plunge as COVID-19 pandemic upends global economy', press release, 8 April 2020, https://www.wto.org/english/news_e/pres20_e/pr855_e.htm (accessed 26 May 2020).
207 Torrente-Velásquez, J., Ripa, M., Chifari, R., Bukkens, S. and Giampietro, M. (2020), 'A waste lexicon to negotiate extended producer responsibility in free trade agreements', *Resources, Conservation and Recycling*, 156, 104711, doi:10.1016/j.resconrec.2020.104711 (accessed 17 May 2020).

to China and the US. Together, Colombia, Ecuador, Panama and Peru exported 60,000 tonnes to those two major economies, with 41,000 tonnes exported to China from Ecuador and Peru alone, and 11,000 tonnes from Ecuador to the US.[208]

As noted above, the circular economy offers opportunities to increase the valorization of waste at the national level. In the case of e-waste, currently the region is focused on dismantling while sending the valuable fraction to Europe, the US and China for recovery of precious and rare metals including gold, lithium and cobalt. To do this domestically requires investment in new facilities and programmes for safe recovery of e-waste. The national regulations around hazardous waste would need to be harmonized and expanded to the regional level and allow the consolidation of e-waste in large enough quantities to supply the necessary input for recovery facilities.[209]

Box 11. Mercosur and the EU free-trade agreement – opportunities for the circular economy?

In its current state, the trade agreement between the EU and Mercosur – the customs union that includes Argentina, Brazil, Paraguay and Uruguay – does not contain any provisions to support the development of the circular economy. Instead, as it stands, the deal is expected to increase the amount of high-impact agricultural commodities, in particular animal products and biofuels.

The EU and Mercosur reached a political agreement in June 2019 for the forthcoming FTA, but it still awaits ratification. Should the trade deal be renegotiated, it will be important to include mechanisms for environmental protection, especially for deforestation. There is concern around the possible impacts of tariff reductions on deforestation, especially in Brazil. The agreement could increase demand for agricultural commodities, leading to the expansion of the land area used for agricultural production and the loss of natural forest, even if existing agricultural land is used more productively.[210]

Under the terms of the draft agreement, exports from Mercosur countries to the EU are expected to see increases across a number of products. Exports of beef, for example, are expected to increase by 50 per cent from the current volume of 194,000 tonnes per year. The beef quota, which is currently 200,000 tonnes, will increase to 299,000 tonnes per year. Exports of ethanol are expected to increase by 540 per cent. The EU currently imports 102,000 tonnes of ethanol per year: a new 650,000 tonne per year quota will allow massive expansion in ethanol trade. In return, the EU is expected to increase its cheese exports to Mercosur by 710 per cent (Mercosur currently imports 3,700 tonnes per year, whereas the new quota is 30,000 tonnes per year), while imports of skimmed milk powder from the EU to the four Mercosur member states will increase by as much as 1,200 per cent

208 UN Environment Programme (2018), *Waste Management Outlook for Latin America and the Caribbean*.
209 Alvarenga, H. and Perrier, E. (2018), 'Latin America Regulators Embracing E-Waste and Battery Collection Laws', *In Compliance,* 30 March 2018, https://incompliancemag.com/article/latin-america-regulators-embracing-e-waste-and-battery-collection-laws/ (accessed 18 May 2020); Boeni, H., Silva, U. and Ott, D. (2008), 'E-Waste Recycling in Latin America: Overview, Challenges and Potential', paper presented at the Global Symposium on Recycling, Waste Treatment, and Clean Technology, 12 October 2008, Cancún, Mexico, https://pdfs.semanticscholar.org/6016/d21f366426c5916ba5dab88b780fa5833f48.pdf (accessed 18 May 2020).
210 Baltensperger, M. and Dadush, U. (2019), 'The European Union-Mercosur Free Trade Agreement: prospects and risks', Bruegel Policy Contribution, Issue 11, September 2019, https://bruegel.org/wp-content/uploads/2019/09/PC-11_2019.pdf (accessed 18 May 2020).

(Mercosur currently imports 771 tonnes per year: the new quota has been set at 10,000 tonnes per year). The EU–Mercosur FTA will be a powerful driver for the industrial food systems in both regions. As a result of the envisaged growth in trade of these commodities, associated greenhouse gas emissions will increase by about one-third, from 25.5 million tonnes of CO_2 equivalent per year, to 34.2 million tonnes per year.[211]

Through renegotiation, there could be opportunities to include elements of cooperation to promote trade that is conducive to the circular economy transition in both regions. For example, the EU's European Green Deal (announced in December 2019) and revised Circular Economy Action Plan (March 2020) provide for the development of product passports. Technical cooperation mechanisms to enable the EU and Mercosur member states to work together on product passports to improve transparency in supply chains could be negotiated into the FTA. EPR provisions to regulate trade of waste, and tariff reductions on secondary materials and remanufactured goods to support circular business models, could also be included.

211 GRAIN (2020), 'EU-Mercosur trade deal will intensify the climate crisis from agriculture', 25 November 2019, https://www.grain.org/en/article/6355-eu-mercosur-trade-deal-will-intensify-the-climate-crisis-from-agriculture.

06 Conclusions and recommendations

The circular economy has a central role to play in LAC, but the success of the model will depend on the strength of alliances, both within and between countries.

Despite the challenge of moving away from the current linear economic model, the proliferation of circular economy related strategies, policies and initiatives in LAC suggests that many governments – and businesses – understand the potential of circular models of growth. However, a number of critical questions remain over the implementation of national circular economy policies and their alignment with economic and industrial policies. Can the countries of the region balance the demands of the private sector with wider environmental and social policies? The following points outline the key areas that will determine the success of circular economy transitions in LAC:

- Forging productive partnerships and transformative alliances, both within and between countries in the LAC region, is crucial for a successful transition to a circular economy. Cooperation is needed at the regional level to coordinate and scale up initiatives, share best practices and, at times, pool technical and financial resources. Advancing and operationalizing a regional circular economy alliance and roadmap, as discussed by the regional Forum of Ministers of Environment in late 2019, presents an opportunity to advance a common circular economy narrative and political agenda in the region. Furthermore, regional initiatives such as the Circular Economy Platform of the Americas[212] and Circular Economy Forums[213] provide important opportunities for stakeholders to openly share their knowledge and experiences.

212 Circular Economy Platform (2016), 'Empowering Circular Economy In the Americas', https://www.cep-americas.com.
213 For example, see FORO de Economía Circular Chile (n.d.), https://foroeconomiacircular.com (accessed 22 Jun. 2020).

- The aftermath of the COVID-19 crisis provides a unique opportunity for a green recovery; a just transition to a circular economy offers a suitable framework to ensure an inclusive and environmentally, socially and economically resilient future for the region. The lockdowns imposed at the country level have exposed the fact that, in the current linear system, what is good for the economy is rarely good for the environment or society. The significant increase and rebound in emissions and pollution to pre-pandemic levels in many countries,[214] following the end of lockdown measures, show that the linear economic model is not an option for a sustainable recovery in LAC.
- One key factor for success will be the degree of long-term commitment shown by the region's political leaders to the global sustainability agenda and the SDGs. Political leaders and governments who understand both the opportunities and challenges associated with the circular economy transition, including the social aspects, will be key players, given their ability to introduce and enforce legislation that promotes circular models and addresses identified challenges.
- Increasing state capacity and building strong, transparent institutions are important to ensure the transition from a linear to a circular model. Strong institutions for integrated and coherent policymaking – which address resource efficiency and waste management policies and align them with budgeting and social policies – are key for a just circular economy transition that promotes economically, environmentally and socially resilient societies.
- To ensure just transitions and inclusive political processes, such as participatory roadmapping processes, it is essential to actively involve all stakeholders. Lack of public trust in political leaders presents a significant challenge for many countries in the region, and regaining this trust is part and parcel of ensuring the acceptance of transparent and participatory processes.
- The challenge of municipal waste management must be a priority for national and local governments in the LAC region. The inclusion of informal sectors in municipal waste policy initiatives is one example of the social issues to be considered in a just transition context. The transition to a circular economy in the LAC region requires significantly improved municipal waste management, reduction and recycling systems for plastics, wastewater recycling and secondary materials markets. LAC countries that manage to establish such systems, especially in the aftermath of the economic crisis caused by COVID-19, could reap benefits in terms of improved public health and environmental quality, job creation, revenue, and enhanced access to critical secondary materials for local businesses.
- Governments also play a critical role as sources of funding for new initiatives in infrastructure, education and R&D, which are important for instigating and linking the circular economy transition with the development of Industry 4.0 technologies. International development finance institutions will need to expand their funding portfolios beyond waste management to support

214 Plumer, B. and Popovich, N. (2020), 'Emissions Are Surging Back as Countries and States Reopen', *New York Times,* 17 June 2020, https://www.nytimes.com/interactive/2020/06/17/climate/virus-emissions-reopening.html (accessed 18 Jun. 2020).

innovation and the uptake of technology for the circular economy. Public funding is not enough, however, and governments must also incentivize the private sector to mobilize resources for a digitally enabled circular economy.

— The winners in the circular world will be the individuals, companies and countries that are able to innovate and create business opportunities in the new environment. Country-level factors such as the quantity and quality of infrastructure, the degree of digitalization and technological advancement, level of human capital, and access to finance are all likely to be important. By working together, national governments, cities, companies, universities and civil society stand a greater chance of capitalizing on the opportunities of the circular economy transition.

— Entrepreneurship has important potential for the circular economy in the LAC region, as this community is already innovating in the reuse, sharing and recycling space. More financing is needed, however, to scale up these ideas and build the required networks. Furthermore, support for social innovation in the circular economy is needed to ensure inclusiveness and to achieve progress on the social objectives of the SDGs.

— LAC countries should continue to encourage the growth of circular economy business models, to drive innovation and capture value, and create high quality and decent jobs in addition to exporting raw materials. While continued strong growth is expected in demand for primary resources in many middle-income countries and emerging economies, at least in the short term, access to markets in Europe, the US and even China will increasingly become subject to environmental standards and circularity criteria, which are likely to become part of future FTA negotiations.

— EPR policies and governance models in LAC countries need to incentivize not only producers, but other actors in the supply chain, to carry out their allocated tasks and responsibilities. The effectiveness of EPR policies will require the introduction of ambitious yet feasible targets. Furthermore, efficient information management systems and online registries are needed. Additional economic instruments to complement EPR systems can be used to promote secondary materials markets. Finally, it will be necessary to establish complementary policies to promote eco-design and product innovation and to strengthen regulatory controls over intellectual property.

— The transition to, and policies for, an inclusive circular economy need to be guided by an increasingly robust and ambitious science base. Education programmes and research capacity on the circular economy are developing within the LAC region but need to be strengthened further. International research partnerships can contribute to increase the innovation capacity of LAC institutions. Transdisciplinary research approaches, co-creation with societal stakeholders, and social innovation are important to ensure sustainable and socially just outcomes.

— To become leaders in a sustainable circular bioeconomy, LAC countries must ensure that significant value addition is generated within the domestic economy. Simply exporting unprocessed natural resources and biomass

to supply other regions such as the EU, US or China, and not develop their national bioeconomies, is insufficient and will not deliver on environmental, social and economic objectives. The challenge here is twofold: how to shift from large-scale agriculture, commodities and energy crops that drive deforestation and biodiversity loss to regenerative food systems; and how to create sustainable value chains for new goods and services derived from biodiversity assets.

Annex

Methodology for the Chatham House survey 'Building Transformative Alliances for an Inclusive Global Circular Economy'

Below is a description of the methodology used for the Chatham House survey, which was conducted in December 2019 following a research workshop on 'Just Circular Economy Transitions in Latin America', which took place in Montevideo, Uruguay. The purpose of the Chatham House survey was to gain an insight into how the circular economy is understood in LAC countries, among leading stakeholders from governments, international organizations and the business community. The information collected was used to inform research on promoting an inclusive and sustainable circular economy agenda in the region.

Respondents were asked a number of open-ended questions based around certain themes:

Sectors

- Which sectors are likely to benefit most from the transition to the circular economy in LAC and why?
- Which sectors are likely to face the largest challenges in the transition to LAC and why?

Policies

- What are the most important policies that can be introduced at the national level to advance the circular economy in LAC?
- What type of policies are needed to ensure the circular economy transition is inclusive?
- What are the main challenges related to the implementation of these policies?

Transition and innovation

- What type of changes need to be made at international level to promote an inclusive circular economy transition (related to policy, trade, finance etc)?
- What type of changes need to be made at regional level to promote an inclusive circular economy transition (related to policy, trade, finance etc?)

— What key technological innovations can drive the circular economy transition in LAC?

Finance

— Which are the most important sources of circular economy finance in LAC?

— Which types of circular economy projects or businesses attract little or no funding? Why?

— What should be priority areas for circular economy financing?

— What are the main barriers to scaling up circular economy finance?

General

— How can European–LAC trade relations support the circular economy transition?

— Do you see any trade-offs between the circular economy and other social, environmental or economic issues?

— Do you have any additional thoughts or recommendations?

Survey response

Twenty-eight respondents from 11 countries responded to the survey:

LAC countries	Rest of the world
Argentina	Aruba
Brazil	US
Chile	
Colombia	
Ecuador	
Mexico	
Peru	
Uruguay	
Venezuela	

Due to the small sample size, the results of the survey should not be seen as indicative of broader perceptions across LAC, given a lack of participants from countries such as Costa Rica and Bolivia. Although the aim of the sample was not to be representative, it was designed to generate a diverse range of qualitative responses, allowing for a greater understanding of the opportunities, challenges and trade-offs involved in a transition to the circular economy in LAC.

About the authors

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Cover image: Protective face masks are produced using 3D printing technology in a Fab Lab at Casa Firjan on 30 March 2020 in Rio de Janeiro, Brazil.
Photo credit: Wagner Meier/Stringer/Getty Images

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