

## **CURRENT SCENARIOS OF CIRCULAR ECONOMY IN BRAZIL AND ECUADOR: REVIEW ARTICLE**

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### ***ABSTRACT***

*The circular economy offers alternatives to provide concrete solutions to productive, environmental, and social challenges worldwide, especially for developing countries such as in Latin America and the Caribbean region, where the economic models are heavily dependent on natural resource exports. The literature review briefly describes the current scenarios of the circular economy in two Latin American countries (Brazil and Ecuador). The paper describes the importance of the Circular Economy (CE), the public policies implemented in these countries during recent times, and the main challenges they face to achieve a transition from the traditional economic model to a more sustainable one. At the global level, there are various mechanisms and policies that drive the transition from a linear to a circular economy. However, developing countries such as Brazil and Ecuador do not yet have specific policy frameworks that encourage the circular economy as a governmental policy. The outstanding challenges and actions for achieving CE in the case of the countries considered remain large and require the joint effort of all actors involved at the public, private, academic and public care levels in general.*

Keywords: Circular economy (CE), Latin America and Caribbean (LAC), Policies, 3R principals, Challenges

JEL codes: O54, Q01, Q20, E60.

### **INTRODUCTION**

Latin American and Caribbean (LAC) national economies have heavily depended on natural resource exports for the last two decades. Until now, many countries have yet capitalized on this specialization in natural resource exports. In this context, the circular economy offers an opportunity for intersectoral 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) (Schröder *et al.*, 2020).

The circular economy offers alternatives to provide concrete solutions for the production, environmental and social challenges of our times. Nevertheless, to fully avail the region's potential, a new vision must be reflected in strategies, policies, and programs that promote a more inclusive and sustainable model that does not sacrifice growth, efficiency, or profitability (IICA, 2018). In recent years, the circular economy

model has gained high-level political attention and support in Latin America and the Caribbean (LAC). The region has already launched more than 80 public initiatives relating to the circular economy.

In the ideal scenario, the circular economy transition achieved by Latin America and the Caribbean countries could produce abundant renewable energy and materials driven by regenerative and circular business models that support biodiversity, enable it to flourish, and keep it clean from waste and pollution. It is a transition based on nature-inspired solutions unlocking world-leading innovation and well-being improvement (CEC, 2021).

The World Conservation Monitoring Centre (WCMC) of the United Nations Environment Program has identified a total of 17 mega-diverse countries, Brazil and Ecuador included. According to *Iberdrola* (2018), these countries possess an essential percentage of the world's arable land, freshwater resources and are one of the primary producers of sustainable biomass.

Despite having invaluable natural resources, both countries have limitations in adopting sustainable policies that allow the transition of their traditional economies to a circular model. In each country, certain legal frameworks have been outlined to facilitate the adoption of the circular economy. However, they have yet to be implemented directly with the different societal actors.

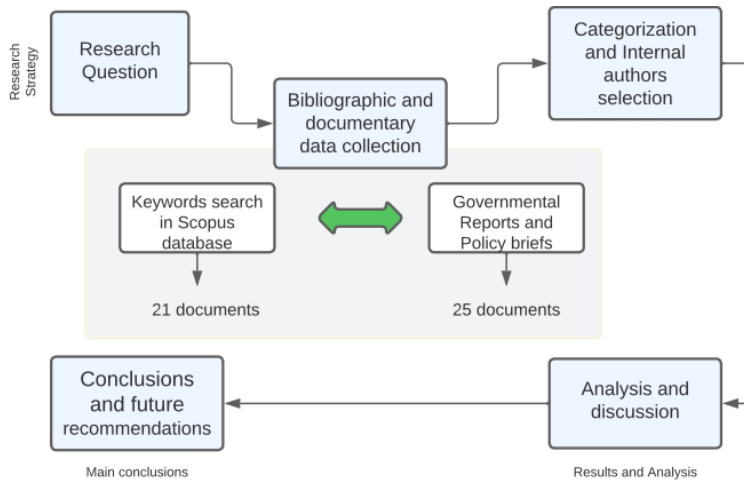
This review article briefly describes the current circular economy scenarios in two Latin American countries (Brazil and Ecuador). The paper describes the importance of the circular economy in the two countries, the public policies that have promoted this model in recent years, and the main challenges they face to achieve a transition to the circular economy.

## **MATERIALS AND METHODS**

The methodological approach of the research is a qualitative literature review based on secondary data obtained mainly from official government documents, international reports, and journal articles related to the research topic. The information obtained from the bibliographic databases was categorized according to the issues addressed in the literature review, from general aspects of the circular economy to particularities in the public policies of the two countries under study. The following search of keyword and exclusions were applied in Scopus database: TS=( "circular economy" ) AND ( "Brazil" ) AND ( "Ecuador" ) AND ( LIMIT-TO ( EXACTKEYWORD , "Circular Economy" ) ) AND ( LIMIT-TO ( AFFILCOUNTRY , "Ecuador" ) OR LIMIT-TO ( AFFILCOUNTRY , "Brazil" ) ) AND ( EXCLUDE ( SUBJAREA , "PHYS" ) ). Once the evaluation was done, the authors concluded with the main challenges that the circular economy could have as an economic model in Brazil and Ecuador. *Figure 1* describes the flow chart used in the research as mentioned earlier.

According to *Snyder* (2019), qualitative literature reviews perform an essential role as a foundation for all types of research. It can serve as a basis for knowledge development, create guidelines for policy and practice, provide evidence of an effect, and have the capacity to engender new ideas and directions for a particular field.

Figure 1. Flow chart of the research



The primary purpose of a literature review, according to the *Western Sydney University* (2017), is to obtain an understanding of the existing research relevant to a particular topic or area of study and to present that knowledge in the form of a written report. In addition, a bibliographic review also makes it possible to present important concepts in the field of the study and to obtain information to formulate some recommendations about the problems addressed.

## LITERATURE REVIEW

### Concept of circular economy

According to (*European Parliament, 2023*) the circular economy “is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible”. The fundamental principles of circular economy are to reduce, recycle and reuse all types of materials, including metals, minerals, and biological resources (*IICA, 2018*). The concept of the circular economy has been chiefly associated with adopting closing-the-loop” production patterns within an economic system and increasing resource use efficiency, focusing on urban and industrial waste (*Ghisellini et al., 2016*).

These concepts began to develop in response to the crisis of the traditional model due to the need to deal with the limited resources (*Coste-Maniere et al., 2019*). Especially for natural resources from where humanity has access to most of the raw materials, addressing the increasing demand for food, feed, energy, materials, and products (*Gottinger et al., 2020*). It also stems from the idea of closing economic and ecological loops in resource flows, reducing both virgin material inputs and waste outputs (*Haas et al., 2015*). According to *Valavanidis (2018)*, one of the main objectives of CE is to increase the harmony between economy, environment and society through a focus on resource and waste efficiency. Along with the definition

of circular economy, the development of newer theories such as regenerative design, performance economics, cradle-to-cradle, biomimicry and blue economy merged as complementary aspects of this concept (Ghisellini *et al.*, 2016).

The French environmental agency (ADEME) defined the circular economy as an economic system of exchange and production intended to increase the efficiency of the use of resources at all stages of a product's life cycle, including goods and services (Ministry of Environment of France, 2016). Figure 2 shows the scheme of the three areas and seven pillars of CE, where the main aim is to avoid the creation of ultimate waste that would exit the production system as much as possible.

**Figure 2. Three pillars of Circular Economy**



Source: Based on Héry & Malenfer (2020)

To link the bioeconomy concepts with the principles of the circular economy, researchers developed another exciting term, „biomass-based value web” (Virchow *et al.*, 2016). This impression considers the cascading use of biomass and the use of by-products from biomass processing, leading to an interlinkage of different value chains. For example, the research of Scheiterle *et al.* (2018) present a case study of Brazil's sugarcane sector.

### **Main challenges and opportunities of the Latin America and Caribbean Region**

According to Schröder *et al.* (2020), the LAC<sup>1</sup> is the most urbanized region in the world with more than 80 per cent of its total population living in cities in 2018. The cities and the municipal governments of this region are key players in the circular economy transition. Most cities face significant challenges in dealing with municipal solid waste. The amount of waste generated in the region is expected to increase from

<sup>1</sup> Acronym of Latin America and the Caribbean

541,000 tons/day in 2014 to 670,000 tons/day by 2050. Currently, all countries in the region rely overwhelmingly on the use of landfill or illegal dumping as their primary methods of final disposal. A critical objective of circular economy transitions for cities across the Latin American and Caribbean region should be to reduce pollution by supporting communities impacted by mismanaged waste.

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 percent of export revenues in 2017. Similarly, the mining sector plays a prominent role in the economies of Brazil, Chile, Colombia, Guyana, and Peru. The 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 imposed on industries relying on linear business models (*Hoof et al., 2023*).

Forest resources and biodiversity are crucial for the circular economy. Six of the world's 17 'mega diverse' countries are in Latin America and the Caribbean region: Brazil, Colombia, Ecuador, Mexico, Peru, and Venezuela. In this region, forests account for about 46 percent of the total land area, and the region is home to 57 percent of the world's primary forests, the most important forest resources in terms of biodiversity, conservation, and climate. However, there is an urgent need to halt and reverse biodiversity loss in the LAC countries; several studies demonstrate that large-scale bioenergy production competes with food production for space, with potentially severe consequences for food security and land degradation (*Guénard et al., 2022*). Countries in the LAC region should be able to develop their bioeconomy without jeopardizing their contributions to the region's food security and biodiversity protection targets.

In general, terms shifting toward a circular economy that utilizes biological resources more efficiently and promotes sustainable product development that can reduce fossil fuel dependence will require new policies, institutions, and capabilities that prompt and guide the behaviour of stakeholders to maximize potential benefits and minimize the costs involved in transitioning toward this model (*IICA, 2019*). The strategies to be implemented must include general policies and new approaches in areas such as science, technology, and innovation. The strengthening of the human resource component to undertake new CE activities and to devise various rules, regulations, market instruments to guarantee the sustainable and safe development of these new opportunities to capitalize on the circular economy (*OECD, 2020*).

### *Brazil*

A study by the National Confederation of Industry (CNI) with 1.261 industrial companies found that circular economy practices are still not knowledgeable. According to the survey, only 30% of the companies answered that they had heard about the circular economy before the survey, while 70% were introduced to the topic for the first time (*National Confederation of Industry, 2018*).

Regarding the practices related to a circular economy the companies were already developing, according to the numbers of the survey mentioned, 76.5% of them already employ activities aimed at circular economy without knowing it is practicing the initiatives because of their advantages. Cost reduction was the primary motivation

mentioned by entrepreneurs (75.9%), followed by the possibility of generating jobs (60%) and increasing operational efficiency (47.3%). The opportunity to create a new business (22.6%) and most (72.4%) of the participants believe that the actions help to build customer loyalty. Activities are related to the circular economy “Process optimization” is the most common one being indicated by 56.5% of the company’s respondents. In second place, with 37.1%, comes the use of „Circular Inputs,” and third place with 24.1% „Recovery of resources” (*National Confederation of Industry*, 2018).

The implementation of the circular economy, according to *Ritzén & Sandström* (2017) presents some barriers in the transition process, among which the authors cite financial, operational, structural, attitudinal, and technological ones. For Brazil, not so different from what has been happening in other countries, the shift to a circular economy is not presented as a simple process; some barriers and limitations are identified. *Silva et al.* (2019) made a study analysing the case of Brazil, identifying the obstacles that need to be overcome and that constitute how challenges are related to the following aspects:

1. „*Insufficiency in the separation of waste in the source.*”
2. *low acceptance of recycled products by consumers and companies.*
3. *Lack of investments and incentives political and geographic dispersion for companies of the same cycle”.*

Encouraging overcoming challenges, such as insufficient separation of waste and poor acceptance of recycled products, must be guided by environmental education actions at all levels. However, overcoming these challenges involves activities that develop an awareness of the need for changes toward an ecological economy in a systemic way. This implies strengthening environmental policies, more specifically, the PNRS.

Environmental education must be aligned with information that can develop awareness for environmental protection. In this sense, it is necessary to establish social, economic, and ecological responsibilities through changes in attitudes and understanding of the relationship one must have with environmental issues. These transformations involve educational processes not only formal but in the most varied ways that can develop awareness for environmental citizenship (*Fang et al.*, 2023).

Regarding the lack of investments, there is a long way to go. At the municipal level, the difficulties in waste management are related to financial and technical capacity, which compromises the effectiveness of the PNRS (*Alves et al.*, 2016). The problem is evidenced by the delay in preparing the Municipal Integrated Management Plans of Solid Waste (PMRIRS); according to the National Confederation of Municipalities, of the total number of municipalities, only 38.2% had their plans finalized in 2017.

The issue of geographic dispersion is emblematic of Brazil, marked by significant economic differences and communities in their regions. This aspect can make it challenging to integrate processes between companies so that they can share their production.

Another aspect considering a transition challenge for the circular economy is related to the rules of the indirect taxation system in Brazil, which allow taxes to be levied more than once on the same added value. Every time a product is sold, part of the tax is charged repeatedly, making more expensive products (*OECD*, 2021).

### *Ecuador*

According to *Sucozhañay et al. (2022)* in Ecuador, small business<sup>2</sup> and citizen collectives have been practising circular activities such as electrical equipment repair, shoe repair, tailoring, rental stores, organic food production or bulk stores for a long time. However, the concept of the CE as an economic model is relatively new. Some essential Ecuadorian companies have started incorporating the sustainability approach in their business model by implementing economic, environmental, and social strategies related to the CE. Nonetheless, the adoption of circular practices is still uncertain at the country level since the financial system still depends on the extraction and production of raw materials and fossil fuels without sustainable practices of circularity.

Although several initiatives aiming to improve resource extraction, sustainable consumption, reuse of waste materials to manufacture new products, and energy efficiency over the last decade, green innovation and productivity have until recently been very rarely successful in the country, in the context of Ecuador's climate change action, circular economy and bioeconomy provide a framework for a transition to a more diversified, post-oil economy, based on responsible management of natural resources, like oceans, fresh water, and forests, increasing the share of production with high technological intensity and incorporated value added, including digitalization, private export-oriented research in benefit of youth and future generations. However, in the future it is necessary to invest in the higher education sector and academia to generate skills to promote innovation, as well as labour force training programs (*EEAS, 2021*).

### **Policies and laws to support CE**

Governments play a significant role in the transition to the circular economy, which is already on the public agenda of international politics. To better understand the role played by governments and government agencies in this area, it is essential to be aware of the leading public management tools that can be used to promote this transition. The primary public policy instruments adopted worldwide for this purpose are the following ones: regulatory instruments; tax-related actions; measures in support of research, education, and information; collaborative platforms; financial aid; investment in infrastructure; and subsidies for business (*Green Industry Platform, 2015*).

A worldwide movement toward implementing strategies for the transition toward the circular economy model can be observed. The principles behind the circular economy are familiar, and they are enclosed in several laws worldwide. The global scenario shows paths that some countries have taken with satisfactory results. The first public policy directly focused on implementing the circular economy is a Chinese law enacted in 2009, as seen in *Table 1*, but European countries are the ones that have made the most progress in adopting public policies for the transition from a linear to a circular economy. In 2015, the European Union (EU) devised a plan for implementing the circular economy in its member countries. In addition to this plan, member countries have adopted specific national public policies for different sectors of their economy (*National Confederation of Industry, 2020*).

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<sup>2</sup> Refers to formal and informal business

**Table 1. Summary table of International Public Policy**

Countries	International Public Policy	Captions for the summary	Year
China	Circular Economy Promotion Law	Laws and regulations; subsidies; tax-related measures; waste; resources; industrial symbiosis; circular cities; product-as-a-service; state level.	2009
Japan	Law for the Promotion of Effective Utilization of Resources	Laws and regulations; subsidies; tax-related measures; waste resources; circular inputs; design for circularity; state level; and public procurement.	2015
Canada	Resources Recovery and a Circular Economy Act	Tax-related measures; waste; circular inputs; state level; design for circularity; resource recovery.	2016
Germany	The German Resources Efficiency Program (PROGRESS)	Agreements; laws and regulations; waste; resources; product-as-a-service; sharing; circular inputs; design for circularity; state level.	2012
Belgium	Circular Flanders kick-off statement	Agreements; circular cities; public procurement; national level; resources.	2017
Denmark	Denmark without waste – Recycle more, incinerate less	Subsidies; tax-related measures; waste; circular inputs; state level.	2013
Spain	Estrategia d'impuls a l'economia verda e a l'economia cricular	Subsidies; tax-related measures; waste; resources; public procurement; design for circularity; energy recovery; national level.	2015
Finland	Leading the cycle – Finnish road map to a circular economy	Laws and regulations; subsidies; tax-related measures; waste; resources; public procurement; visualization; circular inputs; design for circularity; energy recovery; state level.	2016
France	Institut de l'Économie circulaire White paper on the Circular Economy of Greater Paris 50 measures for a 100% circular economy (roadmap)	Agreements; subsidies; resources; waste; circular cities; public procurement; circular inputs; product-as-a-service; sharing; design for circularity; state level.	2015
The Netherlands	Waste to Resource Programme (VANG)	Agreements; laws and regulations; subsidies; circular cities; waste; resources; sharing; design for circularity; product-as-a-service; circular inputs; state level; product life extension.	2013
United States	USDA Bio Preferred Program	Resources; public procurement; circular inputs; state level.	2002
South Africa	The Western Cape Industrial Symbiosis Programme (WISP) The Recycling and Economic Development Initiative of South Africa	Tax-related measures; laws and regulations; resources; waste; product-as-a-service; sharing; design for circularity; industrial symbiosis; circular inputs; state & local level.	2012
Australia	Australian Packing Covenant (APC)	Agreements; Laws and regulations; resources; waste; circular inputs; state level.	2017
European Union	Closing the Loop	Subsidies; laws and regulations; resources; waste; circular inputs; design for circularity; continental; energy recovery.	2015

Source: based on, (*National Confederation of Industry*, 2020)



The transition to a circular economy is a complex process that requires a broad, multi-level and multi-stakeholder participation and can be facilitated by appropriate policy interventions, as noted *Milios* (2021) in his study about the Circular Economy Taxation Framework.

In the specific case of tax regulation, which includes aspects directly related to the circular economy, regions such as the European Union, through the European Green Deal and the Circular Economy Plan, are promoting a series of reforms to the current tax system that aim to reduce greenhouse gas emissions, accelerate the transition to a circular economy and balance the tax burden on actors that are the highest consumers (*Eboli et al.*, 2021).

In the case of Latin America, there are some countries that have some specific local initiatives and incentivise companies that have sustainable circular economy practices. For example, in Mexico, the Circular Economy System of Querétaro has tax incentive policies related to: (i) CO<sub>2</sub> emissions, (ii) waste disposal and storage, and (iii) compensation tax for the extraction of raw materials. These tax-related regulations represent incentives for companies to reduce CO<sub>2</sub> emissions, waste generation and substitute raw material extraction and resource conservation (*Hoof et al.*, 2023).

In the case of Colombia, in order to achieve minimum targets related to water and energy consumption, Resolution 0549 of 2015 establishes parameters and guidelines for new sustainable buildings. Similarly, regarding energy efficiency, Resolution 196 of 2020 establishes requirements and procedures for accessing tax benefits related to energy efficiency management projects (*Hoof et al.*, 2023).

### *Brazil*

Brazil has not adopted a national strategy to implement a circular economic model. However, some policies, programs, and plans are underway, to a certain extent they are intended to foster sustainability through circular practices and address sustainability-related topics (*Sanchez et al.*, 2022).

The National Solid Waste Policy (PNRS) is the first public policy addressing waste management more comprehensively, leading to discussions on different management tools used in circular economies. Promulgated in August 2010, the National Solid Waste Policy (Law No. 12,305/2010) was a milestone in Brazilian Law for dealing with solid waste management in Brazil. It contemplates concepts of shared responsibility for product lifecycle management and recognizes reusable or recyclable solid waste as an asset with economic value, in line with circular economy concepts.

Accountability raises concerns about proper disposal in ways that are not harmful to human health and the environment. The policy reinforces the responsibility of waste generators, including the whole chain involved: manufacturers, importers, distributors, and traders. Concerns about the final removal and impact of waste further increase the importance of policy instruments such as reverse logistics, promoting reuse, recycling, and more efficient production processes (*National Confederation of Industry*, 2020).

PNRS defines differentiating solid waste from residues as "solid residues that, once all treatment and recovery possibilities through available and economically feasible technological processes are exhausted, cannot be reused for any possible purpose and must be disposed of in an

*environmentally appropriate way*” suggesting that solid waste can be utilized. The PNRS provides for an obligation to structure and implement a reverse logistics system for manufacturers, importers, distributors, and traders of pesticides for their packaging, and residues; batteries; tires; lubricating oils; fluorescent, sodium, mercury vapor lamps and mixed light lamps; and electronic products and their components (Cosenza et al., 2020). It ends the end-of-line concept by turning the production process into a circular one where components of final products that would otherwise be disposed of in landfills are reused as raw material.

The Law also provides incentives for several actions designed to improve solid waste management, as in its article 42, according to which public authorities may take inductive measures and provide financing lines to support, on a priority basis, initiatives intended to prevent and reduce the solid waste generation in manufacturing processes; develop products with lower impacts on human health and environmental quality in their life cycle; selective structure collection and reverse logistics systems; develop research focused on clean technologies applicable to solid waste; and develop environmental and business management strategies designed to improve production processes and allow for waste to be reused (National Confederation of Industry, 2020).

The objectives of the PNRS are in line with the pillars of the circular economy when it comes to reducing waste generation, encouraging the adoption of sustainable production and consumption patterns, improving clean technologies, and stimulating the adoption of reverse logistics and recycling systems (de Mattos & de Albuquerque, 2018).

Brazilian public policy on the circular economy is still very incipient, but its concepts are contemplated in various laws, plans, programs, and projects, albeit in a decentralized way (Celidônio de Campos, 2019; National Confederation of Industry, 2020). It is crucial to create a national strategic plan contemplating concrete measures to foster research, technologies, and business models designed to promote the development of the circular economy in line with Brazil’s economic development needs. Table 2 summarizes the central National Policies related to the circular economy in Brazil that was possible to find based on the secondary data research.

**Table 2. Summary table of National Policies**

<b>Sector</b>	<b>National Policies</b>
Solid Waste	Agreements; public procurement; waste; circular inputs; national.
Climate Change	Laws and regulations; subsidies; tax-related measures; circular inputs; energy recovery; national.
Energy	Laws and regulations; subsidies; tax-related measures; circular cities; sharing; national; energy recovery.
Water Resources	Laws and regulations; subsidies; tax-related measures; resources; circular inputs; national.
Forest Resources	Laws and regulations; subsidies; tax-related measures; resources; circular inputs; national.

Source: Based on different official database

Within the limits set by the PNRS, and in addition to federal legislation, the states and municipalities also act autonomously in establishing their own regulations, standardising waste management and reverse logistics. Within these local regulations and programmes, priority is given to integrated solid waste management, which follows a priority order of action: (i) prevention, (ii) reduction, (iii) reuse, (iv) recycling and treatment of residual waste (including mixed waste), (v) environmentally sound final disposal of residual waste, i.e. waste whose potential for use is exhausted because it is deemed unfit for any other type of use (*Cosenza et al., 2020*).

### *Ecuador*

Significant foundations for a circular policy framework were laid down between 2014 and 2018 in Ecuador. The circular economy-related concepts were integrated into key national legislation; since 2008, the constitution of Ecuador has recognized nature as a subject of rights<sup>3</sup>, becoming the first country in the world to assign it that legal category (*UCUENCA, 2021*).

Ecuador's circular economy future is manifested in strategic policy initiatives like (*European Commission, 2021*):

- National Strategy and Action Plan for the Circular Economy Transition issue in 2021,
- Law for the Circular Economy (under approval by the National Assembly), and the endorsed National Development Plan 2017- 2021 (“Toda una Vida”) which embraces principles of the circular- and the bio- economy, encouraging recycling and extending product lifetime.
- Ongoing policy processes include the Law for Extended Producer Responsibility, a specific normative for electronic waste (expected to be adopted in 2021), and updates to the legislation on nonrecyclable plastics.

Commitment to the Circular Economy was endorsed with the National Pact for a Circular Economy in 2019, signed by over 330 supporting parties who drive the country's transition to a circular economy along nine strategic axes that include industrialization and use of waste, sustainable and resilient infrastructure, eco-design, sustainable business, the progressive substitution of plastics and development of CE indicators (*European Commission, 2021*).

According to the Ministry of Production, Foreign Trade, Investment and Fisheries, the greatest challenge for the State and Ecuadorian society is to move from a linear economy to a circular one, consuming fewer raw materials, optimizing production processes, extending the useful life of products and materials, generating energy, and making better use of waste (*Vice-Presidency of Ecuador, 2019*). *Figure 3* gives a historical account of the main milestones for the green and circular transition that Ecuador has undertaken in the last eight years as part of the national public policy in conjunction with various private actors.

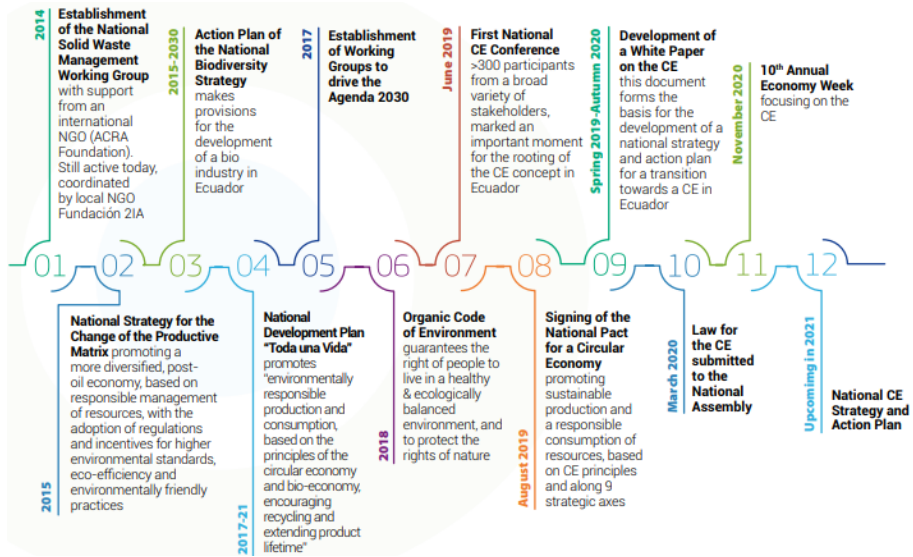
Finally, the main policy instrument on CE in the country is the Circular Economy National Strategy and Action Plan (White Paper) based on four fundamental axes: i)

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<sup>3</sup> “Right to the full respect of its existence and the maintenance and regeneration of its vital cycles, structure, functions and evolutionary processes”

Sustainable production; ii) Responsible consumption; iii) Integrated Waste Management; and iv) Policies and Financing (*Ministry of Production*, 2021). The White Paper aligns the CE concept with Ecuador's 2030 Agenda and the corresponding National Development Plan. This action plan pinpoints the most relevant legal mechanisms to support a CE strategy and identifies five priority sectors (manufacturing, agriculture, commerce, construction, and oil & mining) for the CE transition.

Figure 3. Milestones for the green and circular transition in Ecuador



Source: EEAS (2021)

## Importance of circular economy in both countries

### Brazil

Brazil is the wealthiest country in terms of biodiversity and freshwater quantity; it's the 5<sup>th</sup> biggest country in the world in terms of territory, the 6<sup>th</sup> most populated, and the 9<sup>th</sup> in terms of inequality (*Faria et al.*, 2023). According to the Institute of Applied Economic Research (IPEA), in Brazil, each year, more than R\$ 8 billion reais (Brazilian currency) in different materials are disposed to landfills and dumps instead of being recycled. This scenario must be reversed with the adoption of the circular economy.

The circular economy makes processes more profitable and seeks to restore physical and regenerative resources as natural functions, bringing more significant opportunities to all. There is also a need to organize a structure that punishes or corrects linear logic and, at the same time, rewards the circular economy (*De Assunção*, 2019). This premise must be, for example, in the laws and regulations of the countries regarding the environment and business management, with incentives for organizations that propose to turn the key and adopt the cyclical model.

Rendering to the report, there are initiatives in Brazil that show the country's commitment to promoting habits and consumption that are more in line with sustainable development. The joint guidelines of public and private entities are motivating the movement towards a circular economy scenario, albeit at a relatively slow pace (*Cosenza et al., 2020*).

According to a survey carried out in 2019 by the National Confederation of Industry (CNI), in collaboration with Brazilian industry associations, more than three quarters of all industries in Brazil which represents 76.4% of the total, are adopting circular economy practices in one way or another, but most of them are not aware that their initiatives are in line with this concept (*Valavanidis, 2018*).

Despite the lack of detailed information on the adoption and importance of the circular economy in its broadest sense, some evidence is available in Brazil on its main components: recycling and reverse logistics, i.e. post-consumer activities that allow the re-use of waste collected in the production (*De Melo Faria, 2018*).

From the literature review, there are a number of companies in the country that are applying certain circular economy concepts and policies.

One of them is Natura, Brazil's largest multinational cosmetics company, which uses different seeds from local trees to produce its cosmetics. This also helps to conserve the Amazon's diversity by saving species, providing food and shelter for local animals, and encouraging the local community to preserve their trees as a new source of income. Their biotechnological process combines the intelligence of the indigenous communities of the Amazon ('bio-intelligence') with the latest in gene and protein science (*Ellen MacArthur Foundation, 2017*).

Another important example is Nespresso which is an operating unit of the Nestlé Group. The company has invested around US\$ 36 million in Brazil since 2005. The company is famous for coffee machines and other beverages, the brand created its own solution for reusing aluminium capsules, investing millions of reais in initiatives such as the Nespresso Recycling Center (*Nespresso, 2022*). According to a report on *Época's* website, in 2019, the company collected 22% of the capsules sold through a system mobilized by electric cars in the capitals of São Paulo and Rio de Janeiro. While aluminium is recycled repeatedly, coffee grounds are turned into compost.

In the beverage sector, the giant Coca-Cola and its branch in Brazil FEMSA has several local initiatives favouring the circular economy, such as reusing glass bottles. In 2019, the Coca-Cola bottler celebrated the recycling of 100 million PET bottles in one year through the SustentaPET collection center. The site works in partnership with recyclable material collectors and cooperatives, strengthening their performance and collaborating for the correct disposal of waste (*Ellen MacArthur Foundation, 2017*).

In 2018, the Brazilian Electrical and Electronic Industry Association (ABINEE) promoted reverse logistics in batteries and electrical/electronic products as the main circular economy environmental initiative (*De Melo Faria, 2018*).

In the case of the Brazilian Association of Textile and Clothing Industry (ABIT), they include adopting circular business models as an environmental trend in the sector, which aims to move towards a circular economy. The underlying concept is the creation of new materials that can be more easily recycled and reused, have lower water and energy consumption in their manufacturing process and are biodegradable (*De Melo Faria, 2018*).

*Ecuador*

Ecuador is a country of great natural riches and a growing economy, facing the challenges of the intensification of industrial activity and changing consumption patterns. As a diagnosis made by the *Ministry of Production* (2021), remarks several socioeconomic factors of the country.

- Currently, economic growth depends on the extraction and use of energy resources at a high socio-environmental cost.
- Only 6% of the produced waste is recycled nationwide.
- From 1990 to 2015, there has been a 144% increase in the use of materials and a 181% increase in health damages due to air pollution.
- Official data show a 16.6% reduction in land use for forestry and agricultural activities in the same period mentioned above.

Considering the reality of the country, in recent years, Ecuador has applied a series of public initiatives to lay the foundations for the implementation of the Circular Economy. This effort has been possible with the support and participation of the state, governments, and social actors such as companies, civil associations, and universities, which have understood the need to combat environmental degradation and reduce poverty rates in the country (*Ridaura, 2020*).

The mapping of actors done by *Ministry of Production* (2021), identified 831 organizations that should be involved in the circular economy in the country, to which a survey was applied. Among the results, 47% of these participating organizations indicated that they already have circular economy strategies. The case study conducted by *Garabiza et al.* (2021), shows a fraction of the private companies in Ecuador that apply CE and the type of circular strategies they currently apply (*Table 3*).

**Table 3. Companies that apply circular economy in Ecuador**

<b>Name of the Company</b>	<b>Activity</b>	<b>CE Initiative</b>
Corporation Favorita	Retail Company	Gira Project
Movistar	Telecommunications	Mobile phone recycling
Arca Continental	Bottling Company	Bottle recycling
Nestle Ecuador	Food Company	Recycling of packaging, efficient use of food
Holcim Ecuador	Cement	Geocycle-Waste co-processing
Unacem Ecuador	Cement	Co-processing of used oils and waste
Tetrapack	Packaging and processing of food processing.	Development of sustainable products, and increased recycling
Small Cooking Oil Companies	Recycled Cooking Oil	Collection of used cooking oil to transform it into biodiesel. into biodiesel.
Incinerox	Steel Production	Integral management of industrial waste.
Ecocaucho	Tire company	Tire reuse.
Tritubot	Recycling of plastic bottles-ECOBLOQ.	Recycling of plastic bottles-ECOBLOQ.

Source: based on *Garabiza et al.* (2021).



In the case of Ecuador, the Circular Economy National Strategy and Action Plan defines the actions to be carried out within the prioritized productive sectors such as Manufacturing, Agriculture, Commerce, Construction, and Oil and Mines (*Ministerio de Producción*, 2021).

## **DISCUSSION**

Our society has achieved a high standard of quality of life compared to historical moments of the past because of the structuring drive of the economic, scientific, and technological development it experienced over the last decades. The industrial sector has been vital in this evolutionary process, especially in adding value to natural resources, turning them into products, and making them available to the consumer market (*National Confederation of Industry*, 2020).

Today we are facing new challenges that make it necessary to improve the quality of life achieved for the world population without causing an environmental imbalance that may pose risks to the world economy. According to the Circular Gap Report, only 8.6% of the 100 billion tons of minerals, fossil fuels, metals, and biomass that enter the economy are reused annually. For this purpose, it will be necessary to rethink the economic model adopted so far; it needs to promote a more sustainable flow of materials in our society and put an end to what we refer to as “trash” by considering every material used in our society as a valuable and reusable “resource” (*Aclima*, 2020).

The operation of nature’s cycles inspires us to lay the foundations for transitioning to a model capable of broadly internalizing social and environmental aspects and valuing long-term planning. Public policies are being drawn up in several countries to foster the transition from a linear to a circular logic of thought inspired by nature’s cycles (*De Assunção*, 2019). Companies already identify a trend toward consumers valuing products and services that consider social and environmental issues in their design (*National Confederation of Industry*, 2018).

This new logic has the potential to create and/or reinsert new production chains into the economic system through sharing, reuse, maintenance, remanufacturing, and recycling. The concept of circular economy has shown its strength by combining various practices already being worked on, such as Cleaner Production (CP), Industrial Symbiosis, Cradle to Cradle (C2C), Functionality Economy, Biomimeticism, Design for Environment, Product as a Service, among others.

According to *Azizli* (2021), circular economy is a remarkable sustainable development strategy with great potential to reduce environmental damage, increase material and energy efficiency, create new opportunities for businesses and communities, and is relevant to all types of territories, but it’s implemented differently according to local conditions, especially in vulnerable countries like the ones in LAC region.

In this context, various business opportunities can be identified as we rethink the functioning of the economic system and provide access to the formal market to part of the world population that doesn’t enjoy the benefits and quality of life that a circular economy can provide. Some lines of action that need to be worked on to

accelerate the transition to the circular economy in Brazil, Ecuador, and most developing countries are:

- Public policy: Tax treatment and regulation suitable; sustainable public procurement; and job generation.
- Education: Broad educational campaigns; and professional training.
- Research, development, and innovation (RD&I): Innovation in the design of products, services, and processes. Development of circularity metrics and partnership between the private sector and academia.
- Financing: Guidance for access to resources and project development; and expansion of financing lines for circular economy.
- Market (business environment): Material in quantity and quality for recycling; cooperation in a competitive environment; and identity of the Brazilian industry as sustainable (*De Assunção*, 2019).

The productive sector is aware of its role in solving the challenges that our society will face in the upcoming decades. Nonetheless, increasing management actions between the private sector, public, and academia will be required to create new forms to produce and consume, remembering that both countries are considered unequal and developing. In this way, it is more challenging to apply CE compared to European and North American countries. However, it is highly needed as it would help improve all three sustainability pillars.

## **CONCLUSIONS AND FUTURE RECOMMENDATIONS**

At the global level, there are various mechanisms and policies that drive the transition from a linear to a circular economy that seeks to meet the triple helicopter of sustainability in the social, economic and environmental spheres. However, developing countries such as Brazil and Ecuador do not yet have specific policy frameworks that encourage the circular economy as a governmental policy.

From the reviewed information you can visualize certain initiatives in both countries related to private companies that have circular economy strategies. In addition, in Brazil there is a regulatory framework related to waste management that has several tools that can be used to drive the circular economy. In the case of Ecuador, although there is no specific policy, the government of the country is pushing for a National CE Plan that is pending approval.

The outstanding challenges and actions in the case of study countries remain large and require the joint effort of all actors involved at the public, private, academic and public care levels in general. Taking the comparative advantages into account these countries have due to their natural resources, their transition to a circular economy could be significantly advanced if international partnerships were added to local efforts.

It is recommended for future research, a quantitative analysis of the impact of current circular economy initiatives that exist in the countries of Latin America and the Caribbean, to visualize the importance of this model in the region.



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