

Deliverable 2.4

BRAZIL

Evaluation Report

Project: Assessment of the current status of the Circular Economy for developing a Roadmap for Brazil, Chile, Mexico and Uruguay

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ACRONYMS

ABRE	Associação Brasileira de Embalagem
CE	Circular Economy
CEDES	Conselho Estadual de Desenvolvimento Econômico e Social
CETEM	Centro de Tecnologia Mineral
CDS/UnB	Centro de Desenvolvimento Sustentável da Universidade de Brasília
CNI	National Confederation of Industry
CNODS	National Commission for Sustainable Development Goals
CMV	Cooperativa Mãos Verdes e Núcleo de Economia Circular
EMF	Ellen MacArthur Foundation
ENAP	Escola Nacional de Administração Pública
FINEP	Financiadora de Estudos e Projetos
GHG	Greenhouse Gas
GWP	Global Warming Potential
IABS	Instituto Brasileiro de Desenvolvimento e Sustentabilidade
IBICT	Instituto Brasileiro de Informação em Ciência e Tecnologia
ICT s	Information and Communication Technologies
INS	Instituto Nacional de Semiárido
IPCC	Intergovernmental Panel on Climate Change
iNDC	Intended Nationally Determined Contribution
LCA	Life Cycle Assessment
MCTIC	Ministry of Science, Technology, Innovations and Communications
MDR	Ministry of Regional Development
MME	Ministry of Mines and Energy
NDC	Nationally Determined Contributions
PACTI	Science, Technology and Innovation Action Plan
PNDR	National Policy for Regional Development
PNA	National Adaptation Plan
R&D+I	Research, Development and Innovation
RNV	National Voluntary Review
SEAS	Special Secretariat of Social Articulation



SEGOV-PR	Secretariat of Government of the Presidency of the Republic
SDGs	Sustainable Development Goals
SLU	Serviço de Limpeza Urbana
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UFRGS	Universidade Federal do Rio Grande do Sul
UTFPR	Universidade Tecnológica Federal do Paraná

1. Introduction

This report presents the results of output 2 of the CTCN technical assistance “Assessment of the current status of the circular economy for developing a roadmap for Brazil, Chile, Mexico and Uruguay” RFP/UNIDO/7000003530.

This technical assistance “seeks to lay the foundations for the development of a roadmap to create a general circular economy strategy that generates an economic, social, institutional and environmental impact through the identification of players and territories that have favorable conditions for the development of a circular model, improving the competitiveness and efficiency of local businesses, enterprises and organizations that operate in these three sectors”¹.

A roadmap is a document that shows a high-level overview of goals and objectives organized in a graphic timeline. Instead of doing a detailed description of the details for implementation, a general roadmap must be a simple and flexible tool for managing stakeholder expectations, for communicating the steps and coordinating the resources. It will contain information about important milestones, possible risks and potential dependencies concerning the objectives, designed in a way to be flexible to receive updates and adaptations. Ultimately, this work could create common objectives or a shared vision of what could be identified as a strategy and/or goals for implementing the circular economy in the country.

To this aim, this output 2 presents the definition of some strategic action areas identified as important for implementing circular economy value chains in Brazil and relates it to the National Determined Contributions (NDCs) and commitments to the Sustainable Development Goals, including gender issues associated with circular economy.

The consultations and interviews with potential participants of the general roadmap, have identified the level of experience, knowledge, competencies, networks, interest, strengths/weaknesses and commitment to the development of a circular economy. The interviews were carried out distinguishing between the five categories: (a) Government/Public Sector; (b) Companies; (c) Civil Society Organizations; (d) Academia; and (e) Enterprises. A total of 100 different organizations participated in the survey and 9 actors were interviewed, prioritizing those that are recognized as leaders in initiatives related to circular economy. The definition of players and processes for consultation and/or to be incorporated in the analysis for the development of the road maps were approved by the National Designated Entity (NDE).

This report has prepared an updated map of players in Brazil through the identification of key institutions, agencies, existing initiatives, policy instruments, institutional frameworks and public-private partnerships, as well as local and national initiatives for a circular economy. This was a result of the revision of the legal framework, of expert government players in the field, as well as consultations and interviews with organizations that are leading the topic in Brazil (ministries, government agencies, businesses, associations, universities, groups and entrepreneurs) and international organizations that are developing circular economy models in Brazil.

¹ Technical Assistance Response Plan - Terms of Reference. Analysis of the current situation of the circular economy for the development of a road map for each requesting country.

2. Assessment of strategic areas for CE implementation in Brazil

2.1. Description of some initiatives in strategic areas for the implementation of circular economy Brazil

In this section, some of the identified initiatives currently being developed in the country with national scope are described. These initiatives could be considered strategic action areas for the implementation of the circular economy in Brazil:

Bioeconomy:

The **Bioeconomy Action Plan** of the Ministry of Science, Technology, Innovations and Communications, MCTIC, is the first document from the Brazilian government to acknowledge the circular economy as a guideline, showing a clear view of the importance of the biological cycles for Brazil, in order to support technological and innovation advances in biomaterials and biotechnologies associated to biodiversity and ecosystem services protection.

Life Cycle Assessment:

The **Life Cycle Assessment Project** is an initiative of the Brazilian Institute of Information in Science and Technology (IBICT) to foster the development and adoption of LCA methodology in Brazil, through an information infrastructure that serves industry, academia and society in general. IBICT also leads the Brazilian Life Cycle Assessment Program (PBACV).

Circular Manufacturing:

The National Confederation of Industry, CNI, has been mobilizing efforts since 2017 delivering studies, seeking trends, making proposals to solve bottlenecks and creating a strategic vision for the Brazilian industry, including a new publication “**Strategic industry map for the circular economy in Brazil**” in 2019.

Research and Innovation:

The first financing efforts to support circular economy research, development and innovation initiatives in Brazil came from the **Funding Authority for Studies and Projects, FINEP**, coordinating the ERA-MIN consortium for Research & Innovation Program on Raw Materials to Foster Circular Economy in 2018 and 2019 and the first public call for supporting CE startups in the country. Circular economy promises to be a new line of investments for this organization to support industry, universities and startups dedicated to the circular economy in Brazil.

Low-carbon Agriculture:

The **Sectoral Plan for Climate Change Mitigation and Adaptation for a Low-Carbon Economy in Agriculture, the ABC Plan** decree No. 7,390/2010, is a federal public policy from the Ministry of Agriculture, Livestock and Supply (MAPA), for adoption of sustainable pro-

duction technologies responding to the national commitments of GHG emission reduction in the agricultural sector². Plan ABC has the Brazilian Enterprise for Agricultural Research (Embrapa)³ participation in scientific research on climate change and technology, technology transfer actions, seeking internal and external articulations, and defining the programming to support the commitments assumed for the coming years.

Value chain and regional development:

The most recent initiative reviewed called the "Circular Economy Routes" of the Ministry of Regional Development, MDR, was selected for its innovative approach, leveraging circular economy as an instrument for the development of regions. This program is based on the productive integration between different activities into regional value chains and the development of metropolitan areas through this same approach.

Bioenergy

An effort from the Ministry of Mines and Energy, MME, Renovabio program aims to establish support mechanisms for investments in renewable biofuels, creating a bold carbon credit market, with the objective of placing Brazil among the countries with the cleanest energy matrix in the world.

The most important aspect in these initiatives regarding its strategic value for Circular economy in Brazil are presented below:

2.2. Bioeconomy: Science, Technology, and Innovation Action Plan, 2018

General description: The "Bioeconomy Action Plan" ⁴ fits into a larger context, finding the convergence of national initiatives with the Sustainable Development Goals (SDGs) of the UN 2030 Agenda, where Brazil has committed to reducing considerably its greenhouse gas emissions in the coming years. In addition, given the transversal nature of the bioeconomy, this Plan relates to other Action Plans on Science, Technology and Innovation, PACTIs, with emphasis on sustainable agriculture and renewable energy. The Bioeconomy Action Plan aims to support efforts in scientific and technological development as well as innovative solutions and new business models.

Initiative led by: Ministry of Science, Technology, Innovations and Communications (MCTIC)

Objective of the initiative: The "Action Plan on Science, Technology and Innovation in Bioeconomy" (PACTI Bioeconomy) aims to produce and apply scientific and technological knowledge to promote social, economic and environmental benefits, filling essential knowledge gaps, fostering innovation and providing conditions for the strategic insertion of the Brazilian bioeconomy within the global scenario.

Some relevant achievements: Legal Framework for Science, Technology and Innovation Law no. 13,243/2016; Brazilian Biodiversity Law no. 13.123/2015 and Decree no. 8,772 / 2016.

² <http://observatorioabc.com.br/> Observatory of the actions of the ABC Low Carbon Agriculture Program.

³ <https://www.embrapa.br/tema-agricultura-de-baixo-carbono/sobre-o-tema>

⁴ Plano de Ação em Ciência, Tecnologia e Inovação em Bioeconomia. Brasília, DF: Centro de Gestão e Estudos Estratégicos, 2018.

2.3. Life Cycle Assessment Project (LCA)

General description: The Life Cycle Assessment Project ⁵ produces strategic contents for strengthening LCA, such as technical manuals, studies and scientific articles. It promotes the development of LCA skills through awareness raising courses, introduction to LCA and lectures for government agencies, professional entities and academia.

Initiative led by: Brazilian Institute of Information in Science and Technology (Ibict).

Objective of the initiative: The Life Cycle Assessment Project is dedicated to promote the development of Life Cycle Inventories (LCI) and the dissemination and production of content on Life Cycle Thinking through the integration of partners from industry, government, research institutions and academia that have the common interest in LCA in Brazil.

Some relevant achievements: The National Bank of Life Cycle Inventories (SICV Brasil), is an information system that stores the consolidated set of Life Cycle Inventories adapted to the context of Brazilian industrial production and agro-production. The SICV Brazil centralizes information on LCIs, enabling users from different sectors of government, industry, academia, among others, to keep their inventories within a common link. The initiative also coordinates the Latin American Journal on Life Cycle Assessment (LALCA), first open access publication dedicated exclusively to the theme in the region.

2.4. Low-Carbon Economy in Agriculture, sectoral Plan for climate change mitigation and adaptation (ABC Plan)

General description: The ABC Plan⁶ is composed of seven areas dedicated to research, technology transfer, technical assistance and capacity-building to support the implementation of the ABC Plan, and overcome limitations related to improvement of infrastructure and logistics and access to funding.

Initiative led by: Ministry of Agriculture, Livestock and Supply (MAPA)

Objective of the initiative: The ABC Plan aims to stimulate and monitor the adoption of low GHG emissions actions to agriculture and build resilience combining conservation and economic results through climate change adaptation and mitigation technologies, to meet the country's NDC commitments.

Some relevant achievements:: The Brazilian Agricultural Research Enterprise (Embrapa)⁷ is leading in RD&I and technology transfer initiatives regarding agriculture and livestock sectors, through the programs: (1) Recovery of Degraded Pastures; (2) Crop-Livestock-Forestry Integration (iLPF) and Agroforestry Systems (SAFs); (3) Direct Planting System (SPD); (4) Biological Nitrogen Fixation (BNF); (5) Planted Forests; (6) Animal Waste Treatment; and (7) Adaptation to Climate Change.

⁵ <http://acv.ibict.br/sobre/quem-somos/>

⁶ <https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/plano-abc>

⁷ <https://www.embrapa.br/en/tema-agricultura-de-baixo-carbono>

2.5. Research, development and innovation consortium ERA-MIN 2

General description: ERA-MIN 2 is a consortium⁸ in 2018 that includes FINEP's participation together with twenty-four other global organizations in research, development and innovation, financing in the area of mineral raw materials and their secondary sources focusing on the circular economy. The total budget available for this call was approximately 14.5 million Euros, corresponding to the sum of the public funding commitments of all participating financing organizations. FINEP made 750 thousand Euros available for Brazilian ICTs (Information and Communication Technologies) and other companies to support projects with a minimum of 100 thousand euros budget for each Brazilian candidate. The volume of projects presented in the country exceeded expectations. They add up to requests of 9.4 million euros in financing.

Initiative led by: FINEP, Funding Authority for Studies and Projects

Objective of the initiative: The purpose of the ERA-MIN 2 consortium is to provide financial support through grants for transnational research and development and innovation projects that are jointly developed by companies and ICTs in the non-energy raw materials and non-agricultural sectors, including metallic, construction, and industrial minerals sub-sectors. The focus of these themes is on sustainable sourcing, production, consumption, reuse and recycling of raw materials in a circular economy.

Some relevant achievements: ERA-MIN Joint Call 2017 Raw Materials for Sustainable Development and Circular Economy; ERA-MIN 2018 - Raw Materials for Sustainable Development and Circular Economy Joint Public Call; Programa Finep Startup, 2020.

2.6. Circular Economy: Strategic Path for Brazilian Industry

General description: The National Confederation of Industry works in the mobilization of the industrial sector and in the articulation with the federal government and other interested parties. The report "Circular Economy: Strategic Path for Brazilian Industry"⁹ is a diagnosis of where Brazil stands in relation to the circular economy and of actions that could lead to the transition, led by companies and industry associations and federations. The results are presented in terms of educational, marketing, public policy, financing and research and technological development actions

Initiative led by: CNI, National Confederation of Industry

Objective of the initiative: The National Confederation of Industry (CNI) brings together state industry federations, industry associations and business representatives to assess the degree of national development in relation to the circular economy and to think of strategies to accelerate the transition to this new economic model to draft proposals, based on practices and trends around the world on the subject.

Some relevant achievements: In 2017 and 2018, the CNI published two studies on circular economy, "Circular Economy: Opportunities and Challenges for Brazilian Industry / relating it to Industry 4.0.", carefully investigating the Brazilian context for the theme. In 2018, the "Strategy Map for Industry, 2018-2022" was updated, including the circular economy as one of the key topics for the new themes of the document. This document shows an

⁸ <http://www.finep.gov.br/cooperacao-internacional-externo/era-min-2>

⁹ <https://www.portaldaindustria.com.br/publicacoes/2019/9/economia-circular-caminho-estrategico-para-industria-brasileira/#circular-economy-strategic-path-for-brazilian-industry>

evolution on CNI's vision on the strategic relevance of circular economy. Based on this document, the CNI published the document "Industry Proposals for 2018 Elections: Circular Economy: Efficient Use of Resources", where circular economy is presented as one of the key factors for industry competitiveness, with 7 recommendations related to its implementation in Brazil. In 2020, the National Confederation of Industry released the report "Circular economy: strategic path for Brazilian industry" that presents a diagnosis of Brazil's degree of development in the realm of the circular economy and devises strategies to speed up the transition toward this new economic model.

2.7. Circular Economy Routes - National Policy for Regional Development (PNDR)

General description: In pursuit of the achievement of the objectives of the National Policy for Regional Development, the Ministry of National Integration, through Ordinance MI 162, dated 24.04.2014 - updated by Ordinance MI 80 of February 28, 2018 - established the National Integration Routes¹⁰ as a strategy for regional development and productive inclusion. The routes promote the coordination of public and private actions in selected poles, through the sharing of information and the use of collective synergies in order to foster innovation, differentiation, competitiveness and sustainability of associated enterprises, thus contributing to the productive inclusion and regional development. The Ministry of Regional Development identifies production chains for the implementation of Information and Communication Technology (ICT) and Circular Economy Routes, initiatives that are part of the National Integration Routes program.

Initiative led by: MDR, Ministry of Regional Development

Objective of the initiative: The 'National Integration Routes' are part of the '2029 Program' for Regional and Territorial Development (PPA 2016-2019), aiming to promote productive activities, local productive arrangements and integration routes for regional and territorial development. The 'Routes' are networks of local productive arrangements (APL), associated with strategic supply chains capable of promoting the productive inclusion and sustainable development for Brazilian regions prioritized by the National Policy for Regional Development - PNDR. The 'Circular Economy Routes' are an initiative within this program seeking to promote innovation, differentiation, competitiveness and profitability of associated enterprises regarding circular economy products, services and business models.

Some relevant achievements: Workshops have been held to build a territorial assessment and build a shared action plan, as well as a portfolio of projects for ICT and the circular economy. Representatives from academia and the federal, state and municipal governments have attended the following workshops: 1st workshop on Circular Economy Route Strategic Planning - Polo RIDE-DF, and 1st workshop on Strategic Planning on ICT and Circular Economy Routes - Polo Paraíba. Some of the topics in debate included regional and urban development, competitiveness and innovation, local opportunities and actions for the digital economy and the circular economy, prospects for digital transformation, national policy for sanitation and solid waste, challenges in urban sanitation services, reduction of food waste, circular economy in Brazilian industry, and construction without waste.

¹⁰ <https://www.mdr.gov.br/desenvolvimento-regional-e-urbano/rotas-de-integracao-nacional>

2.8. National Biofuels Policy, RenovaBio

General description: RenovaBio¹¹ is a government policy that recognizes the strategic role of all types of biofuels in the Brazilian energy matrix (e.g. biomass, biogas, ethanol, 2nd generation, bioAQV, biodiesel), aiming to outline a joint strategy for energy security and greenhouse gas emissions reduction. In practice, the **National Biofuels Policy** aims to create a carbon credit market and set targets for its implementation. To create this new market, each oil distributor will be required to purchase CBIOS (Decarbonization Certificates) to offset emissions the volume of fossil fuels produced.

Initiative led by: MME, Ministry of Mining and Energy

Objective of the initiative: To promote the expansion of biofuels adoption in the energy matrix, to improve fuel supply and market stability, as well as energy efficiency gains and greenhouse gas emissions reduction in the production, marketing and use of biofuels. This initiative will provide an important contribution to the fulfillment of Brazil's Nationally Determined Contributions (NDCs) under the Paris Agreement.

Some relevant achievements: Regarding legislation for the National Biofuels Policy: Law No. 13.546/17, Decree 9.308/18 defining the annual mandatory reduction targets for GHG emission for the commercialization of fuels, CNPE Resolution No. 5/18 establishing the annual reduction targets for GHG emissions in the commercialization of fuels, and ANP Resolution 758/18 dealing with the certification for production efficiency or the imports of biofuels, as well as the accreditation of firms for inspection.

¹¹ <http://www.mme.gov.br/web/guest/secretarias/petroleo-gas-natural-e-combustiveis-renovaveis/programas/renovabio/principal>

3. Assessment of NDCs and the SDGs in relation to the implementation of CE in Brazil

In this section, the most relevant information regarding the Nationally Determined Contributions (NDC) of Brazil for the Paris agreement on Mitigation and Adaptation for Climate Change are presented, as well as the general context about the implementation of the SDGs in the country. The circular economy debate is in the early stages in the governmental arena, and therefore no information was found relating it with the NDCs or SDGs¹². Despite that it is possible to assume some conclusions by analyzing the current official information resources available¹³.

In 2015, the Brazilian government presented its intended Nationally Determined Contribution (iNDC)¹⁴ to the Paris Agreement and, with the deposit of the instrument of ratification of the agreement in September 2016^{15,16}, assumed the commitment to implement actions and measures that support the fulfillment of the goals established in the NDC. The country has not presented a plan to implement the NDC from 2020. The information contained in the official letter of Brazil¹⁷ for the Intended NDCs towards achieving the objective of the UNFCCC shows some points that are specially aligned with the circular economy approach in south-to-south cooperation:

"Recognizing the complementary role of South-South cooperation, on the basis of solidarity and common sustainable development priorities, Brazil will undertake best efforts to enhance cooperation initiatives with other developing countries, particularly in the areas of: forest monitoring systems; biofuels capacity-building and technology transfer; low carbon and resilient agriculture; restoration and reforestation activities; management of protected areas; increased resilience through social inclusion and protection programs; capacity building for national communications and other obligations under the Convention, in particular to Portuguese speaking countries."

Due to the country's fast urbanization process, Brazil's climate adaptation policies may focus on key areas like housing, basic infrastructure for health, sanitation and transportation, also in alignment with circular economy systems approach to cities cycles for water, energy, building and sanitation.

In line with the SDGs, the national climate adaptation strategy has the social dimension at its core, with particular attention to the poorest populations. The country commits to implementing its NDCs "with full respect to human rights, in particular rights of vulnerable communities, indigenous populations, traditional communities and workers in sectors affected by relevant policies and plans, while promoting gender-responsive measures".

¹² <http://www.itamaraty.gov.br/pt-BR/politica-externa/desenvolvimento-sustentavel-e-meio-ambiente/712-mudanca-no-clima>

¹³ <https://www.ndcs.undp.org/content/ndc-support-programme/en/home/our-work/geographic/latin-america-and-caribbean/brazil.html>

¹⁴ http://www.itamaraty.gov.br/images/ed_desenvsust/BRAZIL-iNDC-english.pdf

¹⁵ <http://www.itamaraty.gov.br/pt-BR/notas-a-imprensa/14771-deposito-do-instrumento-de-ratificacao-do-acordo-de-paris>

¹⁶ <http://www.itamaraty.gov.br/pt-BR/notas-a-imprensa/14585-aprovacao-do-acordo-de-paris-pelo-senado-federal>

¹⁷ http://www.itamaraty.gov.br/images/ed_desenvsust/BRAZIL-iNDC-english.pdf

3.1. The National Policy on Climate Change (PNMC)

The National Policy on Climate Change (PNMC) Law No. 12,187¹⁸ of 2009, made official Brazil's voluntary commitment to the United Nations Convention on Climate Change to reduce GHG of projected emissions by 2020. The law also establishes the development of country's mitigation and adaptation sectorial plans at local, regional and national levels.

Mapping of vulnerability to climate change requires the development of sectoral and thematic strategies and consideration of territorial dynamics. The PNMC establishes guidelines for sectoral plans and themes for mitigation and adaptation to climate change among them agriculture, industry and mining, electric power infrastructure, transport and urban mobility, health, vulnerable populations, water resources, biodiversity and ecosystems, cities and urban development, natural disasters, food and nutritional security and coastal zones.

The PNMC guidelines fosters practices to effectively reduce GHG emissions and encourage the adoption of low carbon activities and technologies, and more sustainable production and consumption standards. The instruments for its implementation are, among others: the National Plan on Climate Change, the National Fund on Climate Change and the Communication of Brazil to the United Nations Framework Convention on Climate Change.

3.2. Nationally Determined Contribution (NDC) by the Brazilian government

The official letter of the Federative Republic of Brazil for the NDC is a universal, legally binding instrument that fully respects the principles and provisions of the UNFCCC, in particular, the principle of common but differentiated responsibilities and respective capabilities. All policies, measures and actions to implement Brazil's NDC are carried out under the **National Policy on Climate Change** (Law 12,187/2009), the **Law on the Protection of Native Forests** (Law 12,651/2012, hereinafter referred as Forest Code), the **Law on the National System of Conservation Units** (Law 9,985/2000), related legislation, instruments and planning processes. The Government of Brazil is committed to implementing its NDC with full respect to human rights, in particular rights of vulnerable communities, indigenous populations, traditional communities and workers in sectors affected by relevant policies and plans, while promoting gender-responsive measures. Brazil's NDC has a broad scope including mitigation, adaptation and means of implementation.

Mitigation:

- Contribution: Brazil intends to commit to reduce greenhouse gas emissions by 37 % below 2005 levels in 2025.
- Subsequent indicative contribution: reduce greenhouse gas emissions by 43 % below 2005 levels in 2030.
- Type: absolute target in relation to a base year.

¹⁸ http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2009/Lei/L12187.htm

- Coverage: 100% of the territory, economy-wide, including CO₂, CH₄, N₂O, perfluorocarbons, hydrofluorocarbons and SF₆.
- Reference point: 2005.
- Timeframe: a single-year target for 2025; indicative values for 2030 for reference purposes only.
- Metric: 100 years Global Warming Potential (GWP-100), using Intergovernmental Panel on Climate Change (IPCC) AR5 values.
- Methodological approaches, including those for estimating and accounting for anthropogenic greenhouse gas (GHGs) emissions and, as appropriate, removals: an inventory-based approach for estimating and accounting anthropogenic greenhouse gas emissions and, as appropriate, removals in accordance with the applicable IPCC guidelines.

The NDC takes into account the role of conservation units and indigenous lands¹⁹ as forest managed areas, in accordance with the applicable IPCC guidelines on the estimation of emission removals.²⁰

- Use of markets: Brazil reserves its position in relation to the possible use of any market mechanisms that may be established under the Paris Agreement.

Adaptation:

Brazil considers adaptation to be a fundamental element of the global effort to tackle climate change and its effects. The social dimension is at the core of Brazil's adaptation strategy, bearing in mind the need to protect vulnerable populations from the negative effects of climate change and enhance resilience. In this context, Brazil is working on the design of new public policies, through its National Adaptation Plan²¹ (PNA, 2016).

Brazil is a developing country that experienced a fast urbanization process. In this context, risk areas, housing, basic infrastructure, especially in the areas of health, sanitation and transportation, constitute key areas for adaptation policies. The Government of Brazil gives particular attention to the poorest populations, in terms of improving their housing and living conditions, bolstering their capacity to withstand the effects of severe climate events.

It should be further noted that Brazil seeks to enhance its national capacity in water security (National Water Security Plan) and conservation and sustainable use of biodiversity (National Strategic Plan for Protected Areas, as well as the implementation of the Forest Code, particularly concerning protected areas).

Means of Implementation:

¹⁹ "Conservation units" refers here only to federal and state level protected areas; "indigenous lands" refer to areas at the minimum in the "delimited" stage in the demarcation processes. Even without the role of these managed areas, Brazil's contribution would still represent a reduction of 31% in 2025 and 37 % in 2030 in relation to 2005 levels (GWP-100; IPCC AR5).

²⁰ Brazil's Initial National Communication, prior to the applicability of current guidelines, did not consider removals from conservation units and indigenous lands. Such an approach, however, would not be compatible with current guidelines, nor comparable to other Parties' contributions. Disregarding these removals compromised the comparability of the Brazilian initial inventory with other Parties' inventories. Brazil's Second National Communication revised this approach.

²¹ <https://www.mma.gov.br/clima/adaptacao/plano-nacional-de-adaptacao>

Recognizing the complementary role of south-south cooperation, on the basis of solidarity and common sustainable development priorities, Brazil will undertake best efforts to enhance cooperation initiatives with other developing countries, particularly in the areas of forest monitoring systems, biofuels capacity-building and technology transfer, low carbon and resilient agriculture, restoration and reforestation activities, management of protected areas, increased resilience through social inclusion and protection programs, capacity building for national communications and other obligations under the Convention, in particular to Portuguese speaking countries. Brazil invites developed Parties and relevant international organizations to further support such initiatives.

3.3. Governance for the Sustainable Development Goals (SDGs) implementation in Brazil

From the information in the Report (Caderno 57²²) by the Brazilian National School of Public Administration (ENAP, 2018) it is possible to highlight the main efforts that have been developed for the implementation of the 2030 Agenda in Brazil.

In 2016 the federal government has established the National Commission for Sustainable Development Goals (CNODS) by Decree 8,892. The CNODS included members of the federal government, representatives of the productive sector, non-profit civil society, educational and research institutions, municipal governments and state governments. The Commission had a consultative role and its main goals were the internalization, diffusion, mobilization and articulation of actors related to the SDGs (Brazil, 2017). It aims to build institutional mechanisms to setup the conditions for the implementation of the SDGs, including strategies for territorializing, setting goals and indicators, participatory processes and means for implementation, control and monitoring of the 2030 Agenda.

In 2017 CNODS has presented to civil society the SDGs Action Plan with the initiatives planned for 2017-2019. The Action Plan was structured in two axes: (i) internalization of the 2030 Agenda in the government and the federal bureaucracy and (ii) internalization - or territorializing - of the Agenda in subnational governments and non-state agents operating in the Brazilian territory (CNODS, 2017). 167 out of 169 goals from the UN 2030 Agenda were considered pertinent to the country, although 128 goals were required to be adapted to suit national specificities, to give more clarity to their original content or to quantify them more precisely. 8 new targets were created to add to the original ones, accounting 175 national targets in total. The National Voluntary Review (RNV) 2017 was presented at the UN High Level Political Forum, HLPF 2017.

In 2019, the Federal Government Decree No. 9759/19 has substituted the governance structure of CNODS by a governance model articulated around the Secretariat of Government of the Presidency (SEGOV-PR) establishing to the Special Secretariat of Social Articulation (SEAS) the responsibility for the implementation of the 2030 Agenda in Brazil. The main functions of SEAS are listed as follows:

- Assist the Minister of State in matters related to the SDGs.

²² Desafios e condicionantes para implementação da Agenda dos ODS na administração pública federal brasileira. -- Brasília: Enap, 2018.

- Articulate, within the federal government, in conjunction with the Special Secretariat of Federative Affairs, with the federative entities, the internalization actions of the UN 2030 Agenda for Sustainable Development.
- Request and consolidate information on the implementation of the SDGs provided by government agencies.

In 2020, the SEAS/SeGov in partnership with ENAP has started the first phase for the 2020-22 national update and prioritization process of the SDGs targets, with a workshop for the ministries and federal institutions. In 2020's presidential message, the 2030 Agenda was highlighted as one of the government's priorities on page 20 of Chapter I, "Estado Melhor", where it was pointed out that the environmental and social dimensions of the Agenda are being seriously considered, with special attention to the economic perceptions of the 17 SDGs.

3.4. Gender Equality in Brazil

In the past two decades, Brazil has made significant progress in reducing gender inequalities, as a result of the governmental efforts to implement and enhance public policies and legal frameworks that involve women, eradicate gender-based violence and improve financial support for women. Within the public sector, the Secretariat for Policies for Women (SPMW) created in 2003 is charged with mainstreaming gender equality in the various dimensions included in the State administration. Despite these measures, persisting gaps in relation to race and ethnicity still prevail.

In relation to the initiatives implemented by the public sector with regards to the incorporation of the gender approach, the National Climate Change Adaptation Plan includes, within its areas and relevant themes, the Strategy for Vulnerable Populations. The baseline of this strategy assumes that the key factors contributing to vulnerability are issues of race and gender; that is, all gender mentions are associated with issues of vulnerability and indigenous peoples.

With regards to the private sector, Rede Asta is a social enterprise that operates in the circular economy and turns artisans into entrepreneurs who transform waste into goods to improve. Rede Asta is confident that women can be powerful drivers of inclusive economic growth and has decided to invest in female entrepreneurship by training artisan groups to recover various discarded materials and transform them into valuable collections of corporate gifts, a market identified as valuable BRL 5.8 billion (GBP 1.45 billion).

A recent change on this aspect is the requirement-established by the electoral code-that 30 percent of each political party's candidates must be women, and that at least 5 percent of financial resources must be allocated to promoting female political participation and meeting this quota.

3.5. Relation between Brazil's NDC & the SDGs and strategic areas for implementation of CE in the country

From the analysis of the national commitments with the Paris Agreement and the 2030 Agenda, it is possible to relate some SDG's and NDC's with the strategic areas of action that may be key to the development of a circular economy roadmap to Brazil:

Bioeconomy has relevance to drive the sustainable use of natural resources from ecosystems to industrial and agriculture CE value chain development. The bioeconomy is positively associated with land use and forests and water ecosystems conservation, which are mostly related to climate change mitigation strategies in the country. Brazil is a continental country, with the main territorial area of Amazonian and other important ecosystems as well as a huge coastal ecosystem, with most of urban occupation. Having the circular economy implementation in alignment with the national Bioeconomy Action Plan and the climate change governmental initiatives, may be also key to reach the SDGs to contribute to water security and conservation and sustainable use of land and underwater biodiversity, particularly concerning protected areas.

Urban infrastructure, productive inclusion and regional sustainable development has great relevance to the more urbanized regions in the national territory where most of the industrial production and consumption systems are located, and more than 85% of population are living in. The implementation of CE value chain in these territories can contribute with key issues of SDGs for social equity and responsible use of materials and products, which may contribute to more sustainable patterns of development in cities, as well as impacting for climate change adaptation of most of the population.

Industry and Agriculture capacitation and engagement in the circular economy business models and technical knowledge is key to the development of CE value chains. Having these actors and organizations enrolled in circular economy technological and systems innovation and infrastructures is very important to create positive impact in many important SDGs for the creation of more decent work opportunities and have sustainable economic growth. CE approach can be a driver for a change in production and consumption patterns also contributing to reduce GHG emission and the NDCs.

Research, Development and Innovation and Life Cycle Inventories are key to increase the adoption of more sustainable technologies and systems in industry and agriculture sectors driving improvements in production, logistics, infrastructure, machinery, information systems and other efforts. The circular economy value chains may push many advancements towards a more sustainable use of resources in industry and agriculture which impacts. With the support of funding programs for R&D+i for CE technologies and systems in industry and agriculture and adopting broadly the Life Cycle Inventories for CE products and processes can impact in many SDGs for more sustainable innovations as well in more responsible consumption and production, and protecting land and water resources, also impacting in GHG emission mitigations. Above all, these are the pillars for great collaboration and partnerships across sectors which are key for the development of circular economy value chains.

Bioenergy has the highest relevance to supply all CE systems with clean and renewable energy. Energy supply systems sustained from bio-based resources have great impact in climate change mitigation and natural ecosystems conservation. Going towards a 100% renewable energy matrix in one of the most important contributions to countries SDGs and NDC.

By assessing these initiatives of most relevance for the Circular Economy that were identified in the country, it is possible to propose to use table 1 as an initial framework to the structure of the strategic action areas for the implementation of a circular economy in Brazil:



Table 1: Summary of Key actors and initiatives in strategic areas to action and the relation with SDGs and NDCs

Source: Own elaboration

Key Actors	Ministry of Science, Technology Innovations and Communications	Ministry of Regional Development	CNI - National Confederation of Industry	Brazilian Institute of Information in Science and Technology	FINEP - Public Financing Organization for R&D+I	Ministry of Agriculture, Livestock and Supply and Brazilian Agricultural Research Enterprise	Ministry of Mining and Energy
Initiatives	Bioeconomy Action Plan	National Integration Routes: Circular Economy Routes	Circular Economy: Strategic Path for Brazilian Industry	Brazilian Life Cycle Assessment Program	ERA-MIN 2 consortium	Plan for Low-Carbon Economy in Agriculture	National Bio-fuels Policy, RenovaBio
Strategic Action Areas	Bioeconomy national development plan	Urban infrastructure, productive inclusion and regional development	Industry and Supply chains engagement and capacitation	information infrastructure for LCA, and National Bank of LCIs	Research, Development and innovation funding for Industrial sector	Research, Development and innovation for Agriculture Sector	Bioenergy: biogas, biofuels and Carbon Market
Relation to the NDC and SDGs	NDC SDG - 2, 9, 13, 14, 15 11, 12 17	NDC SDG - 10, 11, 12, 17	NDC SDG - 8, 9, 12, 17	NDC SDG - 9, 12, 17	NDC SDG - 9, 12, 17	NDC SDG - 2, 3, 9, 14, 15, 17	NDC SDG - 2, 7, 13, 15, 17

4. Assessment of actors for the development of circular Economy in Brazil

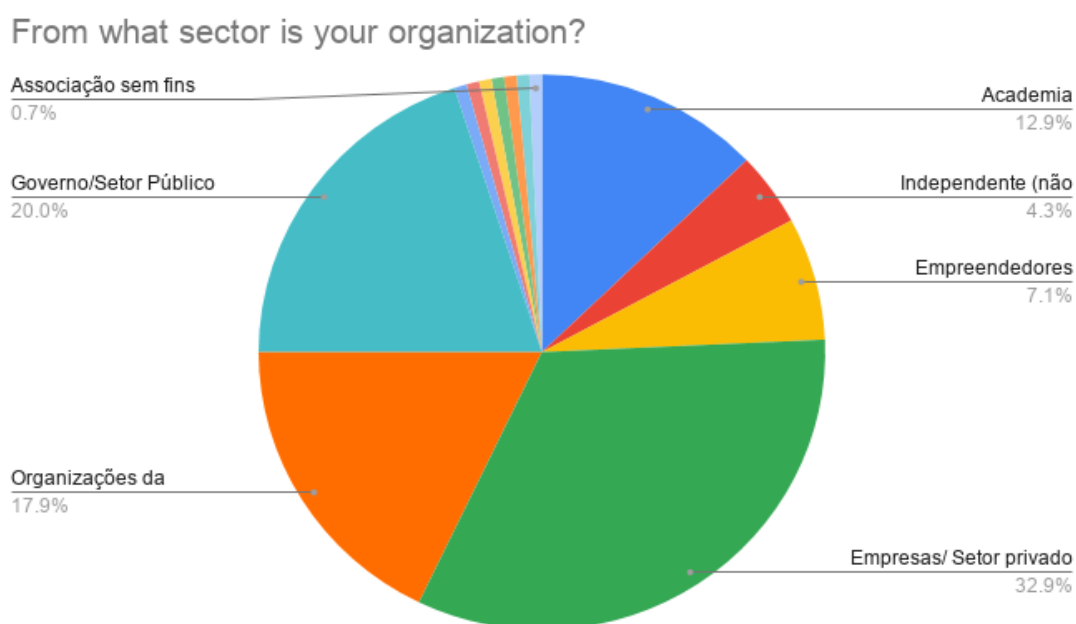
In order to identify actors engaged in circular economy initiatives in Brazil, a methodology was designed, a survey and interviews were conducted to identify key actors and to understand more about the context of the circular economy in the country. The first level survey was made through a public "google form" published in the official website of this technical assistance kick-off meeting, which contains all information about this and the presentations, and sent through several communication channels for the broadest participation possible from different actors that have direct or indirect engagement with circular economy initiatives in the country. The second level interviews were conducted with a small group of actors selected by the NDE with support of the national consultant, to better understand some key issues to the aim of this work.

4.1. Survey to recognize relevant actors in CE initiatives in Brazil

Questions for the survey (Annex1) were developed based on the objectives presented in the technical assistance work plan, discussed collectively and approved by the Brazilian NDE, mainly to assess relevant information to support the implementation of a circular economy in Brazil. An open link for the survey was created and invitations to access this link form were sent by email, Whatsapp and Linked in media. This invitation to answer the form was open to be shared to others.

Figure 1: Respondents to the first survey

Source: Own elaboration





The degree of adoption of the circular economy in Brazil was assessed by identifying the actors assessing them using several questions to better understand their vision, experience, capabilities and commitment to engaging in circular economy models. Respondents represented around 100 different organizations, most of them companies from the private sector (33 %), Government (20 %), civil society (18 %) and academia (13 %). A total of 140 actors participated to the first level survey, being 55% of them women. A total of 19 actors were selected to be invited for the interviews, of which 11 were women. Due to time restrictions, only 9 of the invitees could manage to participate in the interview, 33 % of them were women.

The circular economy has a systemic and broad approach in multiple areas and fields. In line with this, in Brazil the initiatives in the survey also presented many aspects both for the technological and the biological cycle of the circular economy. The answers showed a very wide range of different perspectives and ways to apply the circular economy in the country, which the most important highlights are presented in the summary of the answers in Table 2. As a general assessment, these wide and diverse kind of answers make difficult to set a main profile from the CE initiatives in Brazil. This also represents that there is no clear objective or shared vision on what could be identified as common strategy and/or goals for the circular economy implementation in the country. To illustrate this, the table below presents the initiatives related to circular economy reported by the actors in this first survey, from the responses to the question *"How do you describe the circular economy applied to your field of work?"* (Annex 2), aggregated by each sector. A complete database of answers provided to the survey conducted through Google Forms is attached as an Excel file.



Table 2: Summary of some of the existing circular economy initiatives in Brazil

Source: Own elaboration

CIRCULAR ECONOMY INITIATIVES	
Govern- ment/ Public Sector	<p><u>CETEM, Centro de Tecnologia Mineral (Mineral Technology Center)</u></p> <ul style="list-style-type: none"> More recently, much has been studied regarding CE's action towards the recovery of valuable elements (ores, rare earths, etc.) from waste, or the so-called urban mining, as many of these secondary raw materials are stored in large urban centers. The main sources would be electro-electronic waste, construction and demolition waste, ashes, effluents, among others.
	<p><u>Finep, empresa pública Financiadora de Estudos e Projetos (Public Enterprise for Studies and Projects Funding)</u></p> <ul style="list-style-type: none"> FINEP through its financial instruments and also through international partnerships, such as the ERA MIN 2 program, has been supporting R&D+I projects and programs developed by Brazilian companies and ICTs in the circular economy theme aiming at selecting relevant ICT projects and Brazilian companies to increase the competitiveness of the Brazilian industry through a CE; Under R&D+I initiatives, product and process projects that minimize energy use and waste generation and contribute to a low carbon economy are encouraged. In innovation projects, the circular economy is presented as the use of fewer raw materials for product development, waste reuse, new applications, and new products, linked to sustainability.
	<p><u>CTI, Centro de Tecnologia da Informação Renato Archer (Information Technology Center Renato Archer)</u></p> <ul style="list-style-type: none"> The center develops research applied to circular economics and sustainable development using living laboratory processes, mainly focused on the reduction and recycling of consumer electronics and zero waste
	<p><u>Embrapa, Empresa pública Brasileira de Pesquisa Agropecuária (Public Enterprise for Agriculture Research)</u></p> <ul style="list-style-type: none"> Development of technologies for the use of biomass and use of agricultural residues in industrial and / or agricultural production processes, such as energy cogeneration in the field. Evaluation of the economic, environmental and social efficiency of adopting these technologies. Develop research in life cycle assessment of agricultural and agro industrial products.
	<p><u>Ibict, Instituto Brasileiro de Informação em Ciência e Tecnologia (Brazilian Institute of Information in Science and Technology)</u></p> <ul style="list-style-type: none"> Some of their projects are in the area of life cycle assessment (LCA), solid waste, bioeconomy and sustainability information. LCA is a technique that has much to complement and increase the CE, especially regarding the proposition of metrics to measure circularity and externalities.
	<p><u>CEDES, Conselho Estadual de Desenvolvimento Econômico e Social (State Council for Economic and Social Development)</u></p> <ul style="list-style-type: none"> The council is working on the implementation of the 2030 Agenda in the State of Parana and the circular economy related to several SDGs such as SDG 7 (Ensuring reliable, sustainable, modern and affordable energy access to all), SGD 8 (Promoting inclusive and sustainable Economic Growth, full and productive employment and decent work for all) and SDG 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation).



	<p><u>INMETRO Instituto Nacional de Metrologia, Qualidade e Tecnologia (National Institute of Metrology, Quality and Technology)</u></p> <ul style="list-style-type: none"> • Circular economy is essential for Inmetro to promote the improvement of production processes, more sustainable and durable products, and using the LCAC Tool. <p><u>INS, Instituto Nacional do Semiárido (National Institute of Semiarid region)</u></p> <ul style="list-style-type: none"> • The institute develops research and projects related to water reuse in the semi-arid region, from the use of rainwater for consumption in urban areas, as well as the reuse of treated sewage for agricultural, urban and industrial purposes, giving water a tool with economic value, which will bring social development to the semiarid region of the country, as well as minimize environmental pollution. <p><u>SLU, Serviço de Limpeza Urbana (Urban Cleaning Service)</u></p> <ul style="list-style-type: none"> • The circular economy is applied in many ways, especially in the field of solid waste, composting incentives, selective collection, return of products to the market and more efficient collection routes.
<p>Compa- nies/ Pri- vate Sec- tor</p>	<p><u>Estre Ambiental</u></p> <ul style="list-style-type: none"> • Seeks to reinsert raw materials into the production chain, via mechanical recycling or energy recovery. Operates in the separation of the dry fraction of the MSW composed basically of post-consumer packaging and forwarded to the recycling chain, with the rejection of the process, produced the CDRU. Work with reverse manufacture of WEEE as well as the energy recovery of industrial waste. <p><u>R.S. de Paula Indústria</u></p> <ul style="list-style-type: none"> • Recycling plastic from expired credit cards through a pioneering and innovative technology called Papa Card. Proper and safe disposal goes beyond reverse logistics: all cards are transformed into various products, from notebooks to trophies and medals, providing a new cycle for plastic, generating employment, income and business opportunities. <p><u>Umicore Brasil Ltda</u></p> <ul style="list-style-type: none"> • Works with the application of circular economy for more sustainable processes, where resources used (raw material = metals) return to the production cycle to be reinserted in new products. <p><u>Eolus Consultoria</u></p> <ul style="list-style-type: none"> • Works with wind power generation contracts regulated in Brazil, that have a duration of 20 years from the date of energy supply. In 2032 there will be successive contract termination events. Evaluating what actions are needed to recover the value of the materials that will be discarded in the decommission process. <p><u>Recicleta RJ</u></p> <ul style="list-style-type: none"> • Offers a complete recycling supply chain solution for the proper receipt, sorting, marketing and disposal of recyclables for the recycling industry, ensuring that recyclables do not reach landfills and guarantee raw materials for industries and companies. <p><u>Adidas</u></p> <ul style="list-style-type: none"> • There are departments of the company with this responsibility for products development since its first draft. <p><u>Flextronics International Tecnologia Ltda</u></p> <ul style="list-style-type: none"> • Created the 1st circular economy ecosystem in Brazil, in Sorocaba, the Flex Research, a development innovation center for the electronics industry where technology is developed for its customers' products.



- At the same industrial plant, there is a factory for the manufacture of products, a distribution center to bring products to market and a sustainability innovation center that receives post-consumer products and transforms them back into 100 % recycled raw materials.

Egregora Socioambiental

- Articulates the post-consumer packaging recycling supply chain from packaging collection sites to recycling industries, helping to improve the income and working conditions of waste pickers.
- Seeks to support the strengthening and structuring of waste picker organizations to meet terms of commitment signed by business associations regarding the National Solid Waste Policy.
- Supports the systematization of information about waste management to ensure traceability and guarantee return to the production cycle of materials.
- Influences the academic sphere, where public policies for social inclusion and strengthening the categories of waste pickers are debated.

Tetra Pak

- Seeks for alternatives to Tetra Pak post-consumer packaging recycling by supporting the development of the entire recycling supply chain, reintroducing recycled products into the chain and promoting the use of renewable materials.
- Among all sustainability, circular economy is in today company's top priority. Due to the demand from customers and consumers, it translates into global commitments, business strategy. A specific department is dedicated to CE (including with specific budget as well) and materializes it in various projects.

SUZANO S/A

- Works in the communities and cities in the regions in coordination with internal operations. These are communities and cities that need technologies that can be applied in the waste supply chains.

HP Inc.

- Commitment to CE, in transforming business model for the entire value chain: from procurement and operational excellence practices to the way design, deliver, recover, repair and reuse their products and solutions. This transformation redefines the way do business and how customers uses technologies. Solutions will enable entire industries to eliminate waste and promote efficient circular value chains.

Coca-Cola Brasil

- In Coca-Cola, circular economy is applied to reduce waste (plastics in particular) and a new look at product design

Vale SA

- In the mining sector, the circular economy may increase the relevance to specific and small-scale minerals.

Caterpillar

- "REMAN spare parts" program, where used parts are collected, remanufactured and resold. There is also a metal scrap management by the company.

Firjan



- Works with decision makers and public policy makers to facilitate the application of circularity by their associated organizations, to improve business environment and the regulatory framework supporting the competitive advantages of Rio de Janeiro's industrial sector.

Unilever

- Supports the development of a packaging supply chain for reinsertion of recycled materials and new recycling technologies. Fosters the demand for good quality recycled material and consumer education. It also offers products made with recycled material.

Santa Helena Ind. Alimentos

- Applies circular economy throughout the supply chain, by choosing raw materials and packaging that are recyclable/sustainable.
- Production process must be efficient, without generating so much waste and company's waste disposal must be properly disposed. The consumer must receive clear information on product sustainability.

Abinee / Green Eletron

- Implements reverse logistics of electronics in the country, by the circular economy principles, collecting post-consumer discarded electronics and send it to registered recyclers.
- Has strategic partnership with Green Eletron to find legal, fiscal, technical and economic bottlenecks to be addressed to help companies to implement circular business models in practice.

Santa Luzia

- Santa Luzia's business model is the transformation of plastic waste into raw materials and, subsequently, industrialization and distribution of products for the construction industry, coatings, and furniture.

RatoRói Design Circular

- Applies circular economy new thinking for design bringing important insights into the production process, product and business model.

Circular Brain

- Their digital platform aims to support electronic equipment lifecycle management through traceability of the process of reconditioning and recycling of these products.

Flock

- Flock works with Cradle to Cradle® design and consulting for the transition to circular economy. They apply circular design to sustainable architecture, product design and regional planning projects.

Arquitetura Positiva

- Work based on circular economy, in this case the integrated biosystems, based on the experience gained from working with The Environmental Institute and EPEA since RIO 92.

GeoCidades Planejamento

- Works with circular economy concepts and principles as an instrument to broaden the capacity of actors in the various sectors, to generate more effective solutions to address major development issues, to rethink a path to a more sustainable development.



	<p><u>Exchange4Change Brasil (E4CB)</u></p> <ul style="list-style-type: none"> • is a specialized consultancy that aims to accelerate the transition to the Circular Economy in Brazil by co-creating and adapting global solutions to the local reality.
Civil Society Organizations	<p><u>Instituto Sustentar</u></p> <ul style="list-style-type: none"> • Operates in social and environmental education, research and local development projects. Adopts circular economy in their processes and projects, as well as their discussion networks and in public policies implementation. • Applies circular economy in projects, forums and courses to provide trainings focused on bioconstruction, permaculture, economic model solutions to environmental problems. <p><u>GFI Brasil</u></p> <ul style="list-style-type: none"> • Works worldwide with scientists, investors and food manufacturers (both startups and established businesses), with focus on replacing animal products with food obtained by cell multiplication and herbal alternatives. Plant-based food production add value to agriculture waste, making them fit for use as raw materials. Food based on cell multiplication is a production processes capable of properly processing the waste. <p><u>IBEASA</u></p> <ul style="list-style-type: none"> • Operates in the sanitation area, mainly focusing on the 3Rs: reduction, reuse and recycling, developing projects, education and applications. • Partnering with 'ArqIntelligentia' that works with container architecture, reusing this residue from international trade. <p><u>CMV, Cooperativa Mãos Verdes e Núcleo de Economia Circular</u></p> <ul style="list-style-type: none"> • Works with more than 40 sorting cooperatives in 4 states of Brazil, in the coordination of a social responsibility project at Braskem. <p><u>GUD, Global Urban Development</u></p> <ul style="list-style-type: none"> • Support to the project Sustainable Innovation Zone in Porto Alegre (ZiSpoa) that consists of applying a development model that combines technological and regional development in the city. One of the focuses of this project is to treat the circular economy as a key part of sustainable innovation, promoting recycling actions, efficient use of resources, and encouraging the use of renewable energy sources (solar photovoltaic). <p><u>EMBRAPPI, Empresa Brasileira de Pesquisa e Inovação Industrial (Brazilian Enterprise of Research and Industrial Innovation)</u></p> <ul style="list-style-type: none"> • Supports companies or associations that want to adapt their products and processes to environmentally sustainable and responsible thinking (circular economy) as engines for innovation. • Supports technological challenges to new processes and products and the research and development investments as critical to solve these challenges. <p><u>IABS, Instituto Brasileiro de Desenvolvimento e Sustentabilidade (Brazilian Institute of Development and Sustainability)</u></p> <ul style="list-style-type: none"> • The project "More inclusive Maceió" promotes the development of circular economy models in the city of Maceió, where waste from the sururu's production chain (malacoculture) is not used but is a valuable resource for other production chains. As part of the project, studies and release of various products were carried out.



- The project is currently in the process of implementing a social currency, which will be exchanged for sururu shells delivered by shellfish farmers from the lagoon region. Upon receipt, the shells will be cleaned, crushed and disposed of to the industries that will use this material.

ABRE, Associação Brasileira de Embalagem (Brazilian Association of Packaging)

- Circular economy is today their reference concept for the development of packaging, as a way to contribute to sustainability in society's supply chains.
- Support associated industries in building CE vision as focus for research & development, strengthening reverse and revaluation waste infrastructure, and for education and engagement purposes.

Instituto Akatu

- Consumers play a key role by engaging in new business models and valuing initiatives for enabling CE. Thus, promoting conscious consumption, focus of the Akatu Institute's work, in an educational and perennial manner to ensure that consumers can play their role within the CE.

EMF, Ellen MacArthur Foundation

- The Ellen MacArthur Foundation has been working to accelerate the global transition to the circular economy and has been the organization responsible for embedding the topic in global discussions since its launch in 2010.

ABIPLAST

- ABIPLAST represents the plastics processing and recycling industries, so the circular economy is a daily issue in the association.
- They see the application of circular economy concepts as a great opportunity to reverse this unfavorable scenario for plastic.

Tearfund Brasil

- Organization that has sought to implement a circular economy policy in its own projects as well as in other partner organizations.
- Working on economic models that can best serve poverty reduction, environmental sustainability and inequality.
- working to help communities to embrace the circular economy, creating jobs and saving lives.
- In 2016, published the first report highlighting CE opportunities for developing countries, including Brazil, worldwide.
- Advocate for CE as an alternative development model that can reduce the tension between lifting people out of poverty and protecting the planet, providing a triple victory: increased productivity and economic growth improve the quality and quantity of jobs.
- Continues to work with partners in research and knowledge sharing, targeting the scope for meeting the SDGs. On this regard publishing various materials on the theme of CE to influence in many poor communities in Brazil.

LNBR/CNPEN, Lab Nacional de Biorrenováveis do Centro Nacional de Pesquisa em Energia e Materiais (National Laboratory of Biorenewables of the National Center of Research in Energy and Materials)

- Works in the production of bio-renewable energy through sugarcane, to return agro-nomic and industrial residues to the soil as nutrients (e.g. straw, vinasse) and maintain productive efficiency.



	<ul style="list-style-type: none"> • Uses plant compounds (e.g. <i>lignin</i> and cellulose) to build biomaterials and biochemicals, supporting sustainable supply chain that "consumes" greenhouse gases emitted within the production system itself. <p><u>Rede ACV</u></p> <ul style="list-style-type: none"> • A network using LCA as a tool for a more technical and concrete basis for affirmative orientations for the circular economy. A number of environmental and social impacts need to be taken into account in the life cycle of products and services. It is essential to identify the main impacts ("hot spots") to improve management.
Academy	<p><u>LabCHIS, Laboratório de Cidades mais Humanas, Inteligentes e Sustentáveis</u></p> <ul style="list-style-type: none"> • Research on the metalworking company, with additive manufacturing to reduce 80 % the noble raw material disposal and reincorporate around 95 % of the material in the cycle. • Partner with sustainable construction company, to restore different materials, improve of microclimate and space for pollinators and build awareness of local residents within all process. • Academic consultancy, lectures and research on "products dematerialization". <p><u>UnB University</u></p> <ul style="list-style-type: none"> • PhD research on analyzing the potential of implementation of the circular economy model to Brazilian industrial clusters. <p><u>Unoesec and Unisul University</u></p> <ul style="list-style-type: none"> • Research on circular business models, circular economy practices, circular economy cases, linear to circular transition, circular cities, construction and validation of circular economy measurement, and the change to a more circular economy mindset. <p><u>Fiocruz, Foundation</u></p> <ul style="list-style-type: none"> • R&D initiatives that seek to reduce environmental impacts and material and energy losses, new business models and more efficient management of resources and waste. <p><u>UTFPR University</u></p> <ul style="list-style-type: none"> • Research in Life Cycle Assessment (LCA) to assess the sustainability potential of the circular economy alternatives (monetary, environmental or social) and contribution to improve the sustainability benefits of it. <p><u>UNISANTOS University</u></p> <ul style="list-style-type: none"> • Applies CE in design, public policy and disruptive business models, to revisit and expand concepts of sustainable production and consumption, P+L and LCA from different perspectives. <p><u>UFRGS University</u></p> <ul style="list-style-type: none"> • Teaching and research development in Production Engineering, applying the circular approach to improve product development process management, as a mandatory in this context. <p><u>UniBrasil/Escola de Sustentabilidade/ Sociedade Global</u></p> <ul style="list-style-type: none"> • Teaching the circular economy in construction and urban solid waste management. • Developing a documentary with women who work with recyclables about the social importance of waste, to raise public awareness. <p><u>FEI/SP University</u></p>



	<ul style="list-style-type: none"> • Hold workshops on circular economy to master's students and doctoral research, having academia and companies as guests. <p><u>UNESP University</u></p> <ul style="list-style-type: none"> • Research on Life Cycle Engineering (ECV) for electronic, telecommunications and aeronautical products, bringing together most of the technological products. Through ECV, they hope to promote circular economy in these sectors. <p><u>CEFET-RJ technological education center</u></p> <ul style="list-style-type: none"> • Teaching the circular economy principles in Production Engineering graduation courses and having a master course in regional development and production systems. Influenced innovation and life cycle thinking in all stages of product eco-design, production process and operations eco-efficiency, sustainable consumption and post-consumption. <p><u>UFRJ University, Chemistry</u></p> <ul style="list-style-type: none"> • Supporting the development of 'technology maps' and 'roadmaps' for circular economy and its business models. <p><u>COLAB/USP, Colaboratorio de Desenvolvimento e Participação</u></p> <ul style="list-style-type: none"> • Research center for collaboration in public policy, citizens and social organizations to generate faster and more effective change in production systems, as key to promote the circular economy to a larger scale.
<p>Entrepre- neurs</p>	<p><u>Capital Natural</u></p> <ul style="list-style-type: none"> • Works in the curating and strategic management of sustainability and circular economy content to identify circular business opportunities and partnerships in different sectors. Economic growth decoupled from the exploitation of natural resources depends on dialogue between agents. <p><u>Ideia Circular</u></p> <ul style="list-style-type: none"> • Education and communication initiative on circular design and circular economy that offers online training for professionals and companies for the transition to the circular economy. They promote the dissemination and debate of circular economy in Brazil. <p><u>Bohème Negócios</u></p> <ul style="list-style-type: none"> • The company works to support social entrepreneurship focused on the exchange of goods and services. <p><u>Fluxus Design Ecológico</u></p> <ul style="list-style-type: none"> • Develops cyclical water management in a broad range of contexts for urban, rural and industrial use and also in urban planning for integrated water management. • Applies the circular economy to teach the need for a new water management mindset that leaves behind the idea of an extractive linear economy. <p><u>Coletivo ModaCer</u></p> <ul style="list-style-type: none"> • Acts as a collective for the Fashion & Design industry and its supply chain to support circular economy solutions, assessment and communication to the design of more sustainable products and materials. • Uses circular economy as a tool for rethinking business models to improve services, product performance and apply the products design as a tool to transform the entire supply chain from a cradle-to-cradle perspective: from suppliers to retailers and consumers.



<p>Non-Profit Organiza- tions</p>	<p><u>Instituto C&A (corporate institute)</u></p> <ul style="list-style-type: none"> • C&A Institute supports the creation of circular business models in the fashion industry using the principles of reuse, repair, and remanufacturing, and service models in which ownership of materials is not transferred to the consumer. • Fosters the creation of products designed to enable circular business models (e.g. designed for technical and biological cycles), and this includes the use of safe chemistry. • Supports the promotion of awareness on the fact that industrial production should be based on clean manufacturing (e.g. safe chemistry), renewable energy, and closed loop. <p><u>SEBRAE (Social Organization for SME's)</u></p> <ul style="list-style-type: none"> • Addresses the circular economy through sustainability initiatives. The SEBRAE Sustainability Center - CSS established in 2011 has the mission of managing and disseminating innovative and sustainable knowledge, solutions and practices applicable to small businesses. • A technological extension program, Sebraetec, gives assistance to small businesses towards sustainability.
<p>Not affili- ated to any or- ganization</p>	<p><u>Independent sales, marketing and market development of bio-plastics</u></p> <ul style="list-style-type: none"> • Conducted consultancy services for companies and industries focused on mechanical recycling of PCR plastics, biopolymers and compostable or recyclable materials. • Responsible for the composting pilot project in the city of Mogi Mirim-SP in 2013, using organic waste management with bags produced with BASF certified compostable biopolymer ECOVIO. The project became a model in South America.



4.2. Interview to actors engaged in circular economy initiatives in Brazil

A selection of some actors was carried out in collaboration between the National Lead Consultant and the National Designated Entity (NDE). These actors were selected by their relevance in areas or initiatives considered strategic for the implementation of a circular economy in Brazil and also for their potential capabilities, experience and commitment in CE initiatives in the country. Many different ministries were contacted and personnel from governmental agencies were selected to the interview and contributed to this work. All ministries have been informed about the project and most of them sent representatives to the kick-off meeting. A total of 19 key actors were selected and invited to a one-hour interview, 58 % of them being woman. The table in Annex 3 presents the actors selected for the interview process and who will potentially be involved in the development of a circular economy roadmap for Brazil.

The following Table presents the actors that were interviewed and highlights the main experiences and general commitment with circular economy initiatives. Out of the 9 that were able to be interviewed, 33 % were woman. Full answers from those interviews are presented in Annex 4 of this document.

Table 3: Summary of interviewed actors, its experience and commitment to CE initiatives in Brazil

Source: own elaboration

	Main experience and general commitment with circular economy initiatives
Sergio Monforte <i>Environmental and Sustainability Expert at National Industry Confederation, CNI</i>	<p>In 2014, most of CNI's efforts were on waste management and regulations. In 2017 CNI started to understand more about the circular economy potential in new business models, improve supply chains, job creation, industry 4.0.</p> <p>Also, the CE embraces current efforts in cleaner production and efficiency.</p> <p>In 2019, CNI realized that even though the companies do not perceive the CE concept, many of them have some sort of CE initiatives in practice.</p> <p>Also, companies agree that the CE may be important to competitiveness.</p> <p>CNI has just released the CE Strategic Map for Brazilian Industry with 5 main priority areas to act on: policies, education, R&D+I, financing and market.</p> <p>There is a growing potential for CE in Brazil, especially for job creation, new business models and improvements in the supply chain.</p> <p>The Government is starting to support efforts on this topic, as CNI perceived in the last CE meeting in 2019.</p>
Henrique Vasquez <i>Manager on the Innovation board at the Research and Innovation Financier, FINEP</i>	<p>The experience coordinating the international consortium ERA-MIN and the call for startup, taught them that the CE is one main trend that they need to incorporate.</p> <p>This led to an approximation with the National Confederation of Industry, CNI, as they supported their event on CE in 2019.</p> <p>In the future he believes that it is important to encourage the creation of a multi-stakeholder group to boost CE efforts in Brazil, and he expects that the roadmap could point to this direction.</p>

Carla Tenenbaum Designer and Co-Founder at Ideia Circular	<p>Art and design with discarded materials are a powerful way to impact in the local, small scale communities and to create space to communicate the new CE values and influence how people perceive materials, influencing cultural changes.</p> <p>Efforts to disseminate the circular economy principles through education have also the potential to change the mindset in the industrial design approach.</p> <p>The challenge is to avoid wearing down the term "circular economy" and keeping its meaning relevant and inspiring.</p>
Daniel Carvalho Specialist in the Recycling Market and co-Founder at CICLA	<p>Curitiba is one of the pioneer cities in Brazil where they worked with cooperatives on capacity building for recyclers.</p> <p>Working with the National Movement of Material Recyclers (MNCR) is important because they are one of the greatest social organizations on recycling in Brazil.</p> <p>The work with Coca-Cola Co. has developed indicators to manage the evolution in the relations with partner cooperatives.</p>
Aldo Ometto Professor and Researcher at University of São Paulo, EESC/USP/RC4CE	<p>The RC4CE Research Center for Circular Economy at USP is bringing many industrial sectors together, partnering with CNI, developing the capacitation and finding opportunities in CE for companies.</p> <p>Work with companies such as RENNER and HP/Sincronics are the first time they made efforts in this direction.</p> <p>They need to enroll more actors like the Waste Recyclers Cooperatives and the government to change regulations that are barriers to changes to enable CE in Brazil.</p>
Luisa Santiago Latin America Lead at Ellen MacArthur Foundation, EMF	<p>EMF is working on the food and cities powerful relation, and there are 5 projects to begin in São Paulo City for this purpose.</p> <p>Another program called "new plastics economy" is approaching industry individually and countries as a whole to make commitments to avoid useless and unwanted plastics. After a period improving awareness and understanding about the CE, in 2019 cities are leading the pathway in Brazil. Unfortunately, in the national level, currently Brazil is one of the least prioritized countries for EMF.</p>
Beatriz Luz Consultant and Founder at Exchange 4Change, E4C	<p>The relation with steel production companies showed them that there is a lot of potential to primary industrial sector in Brazil.</p> <p>Another initiative they are developing is a hub for multi-sectorial collaboration among companies to foster CE collaborative solutions.</p>
Tiago Braga General Coordinator of Information Technology and Computing at the Institute of Information Science and Technology, IBICT	<p>They have only had a more general, academic approach to the topic of the circular economy until now.</p> <p>CE opens the potential to communicate sustainability issues related to products and production chains without having to go deep in technical details, in a positive and more superficial way, which is an advantage to influence the market.</p> <p>They believe they need to put more efforts to provide more professional capacity building on CE in order to expand the scientific and professional knowledge on the subject.</p>

<p>Alexandre Szklo</p> <p>Associated Professor in the Energy Program at Rio de Janeiro Federal University COPPE/UFRJ</p>	<p>Most of his professional experience is in indirect areas related to the CE, like industrial symbiosis, chemistry and energy.</p> <p>In his field of research, the CE is understood as a competitive advantage for the industry, especially for climate change mitigation.</p> <p>The CE is a new "vision" to help a more sustainable industrial development. Through green chemistry, for instance, industry is developing innovative materials and production processes that generate "negative emissions" of GHGs, and waste from these processes are to integrate CE systems.</p>
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5. Map of players and strategic areas of action for the implementation of a circular economy in Brazil

The following framework presents a map of players identified that are engaged in circular economy initiatives which are currently being developed in Brazil. All players that have participated in this assessment with the key actors are related to initiatives of national scope which are recognized as potential strategic areas of action to the implementation of the CE in the country. The matrix proposed, which can be converted in a conceptual map, is conceived to be flexible for rearranging and updating information in the framework, along with the creation of the roadmap.

The matrix aims to enable the understanding of potential relationships between players in order to explore elements for the implementation of the circular economy in the different contexts of the country's regions. It is recommended to validate this framework proposal with stakeholders during the process of the CE roadmap development.

This framework may serve as a preliminary baseline to the development of the circular economy roadmap and bring up commitment and experiences from actors to create a shared vision on social, economic and environmental effectiveness of a circular economy for Brazil. Key actors indicated in the framework are expected to have the means for leading the development of circular economy projects and maintain environments for collaboration, capable of encouraging the combination and recombination of the great diversity of initiatives and generate decentralized interrelationships between the other actors identified in this work and others to be engaged.

Table 4: Previous framework relating key actors and strategic areas of action for the implementation of Circular Economy in Brazil

Source: own elaboration

Strategic initiatives	Bioeconomy Action Plan	National Integration Routes: Circular Economy Routes	Circular Economy: Strategic Path for Brazilian Industry	Life Cycle Assessment Project	ERA-MIN 2 consortium	Plan for Low-Carbon Economy in Agriculture	National Biofuels Policy, RenovaBio
Strategic areas of action	Foster policies and articulate with governmental players on science, technology, innovations and communications within the bioeconomy and climate change national plans.	Implement, public policies for urban infrastructure and promotion of regional and productive development and facilitate the governance for clusters and supply chain for productive inclusion.	Bring together state industry federations, industry associations and business representatives to diagnose and think of strategies and draft proposals for technological improvement and international competitiveness.	Foster the development and adoption of LCA methodology and the development of Life Cycle Inventories (LCI), through an information infrastructure that serves industry, academia and society.	Provide financial support through grants for national and transnational R&D+I to companies, universities, technological institutes and other public or private institutions.	Establish support mechanisms for investments in renewable biofuels, creating a bold carbon credit market, with the objective of placing Brazil among the countries with the cleanest energy matrix in the world.	Promote the adoption of sustainable production technologies responding to the national commitments of GHG emission reduction in the agricultural sector.
Key Institutions	MCTIC	MDR	CNI	Ibict	Finep	MAPA	MME
Government/ Public Sector		CEDES, SLU, INS		Inmetro	CTI	Embrapa	CETEM



Companies/ Private Sector		Estre Ambiental, R.S. de Paula, Umicore Brasil, Recicleta, Egregora Socioambiental, Geocidades Abinee/Green Elétron,	Adidas, Flextronics, Tetrapack, HP, Coca-cola, Firjan, Uniever, Santa Luzia,		Eolus Consultoria, Circular Brain, RatoRoi, Flock, E4C	Caterpillar, Santa Helena Alimentos, Arquitetura Positiva,	Suzano, Vale
Civil Society Organizations	GFI Brasil	Instituto Sustentar, IBEASA, CMV cooperativa, GUD, IABS, Tearfund	ABRE, AKATU, EMF, Abiplast,	Rede ACV	Embrapii		LNBR/CNPEM,
Academia	Flocruz	UniSantos, UniBrasil, Colab/USP	EESC/USP, COOPE/UFRJ,	UFTPR, UNESP, CEFET,	LabChis, UnB, Unoesc, UFRGS, FEI, Quim/UFRJ		
Entrepreneurs		Capital Natural, Ideia Circular, Boheme, CICLA	Inst. C&A, Sebrae		ModaCER	Fluxus	

6. Final remarks and insights

The objective of this report was to assess the current status of the circular economy in Brazil and build a baseline for the development of a general roadmap to support the implementation of circular economy in the national level. To this aim, the degree of adoption of the circular economy in Brazil was evaluated by identifying key actors, and assessing their vision, experience, capabilities and commitment to engagement in circular economy models using the methodology of survey and interviews. A total of 140 actors participated to the first level survey. Respondents represented around 100 different organizations, most of them companies from the private sector (33 %), Government (20 %), civil society (18 %) and academia (13 %). A total of 19 actors were selected to be invited for the interviews. Due to time restrictions, only 9 of the invitees could manage to participate in the interview.

Aligned with CTCN's unrestricted commitment to gender equality, the active inclusion of women in each phase throughout this process was considered, ensuring their participation at all decision-making levels and in line with SDG 5 on gender equality. To this aim, during all the activities of this work, the gender perspective was incorporated transversally, associated with a baseline in circular economy issues, in economic, social and environmental implications.

Accounting the actors enrolled in circular economy initiatives in the country, it was verified that women are very present in many of the CE initiatives in Brazil. Out of a total of respondents to the first level survey, 55 % were women, as well as 58% of the invited actors to the second level survey and three of the ones that were interviewed were woman. The responses provided from women perspective in the surveys showed a diversity of understanding of the circular economy potential. Women that responded to interviews highlighted the role of leadership that women have in CE organizations globally and locally.

One of the main objectives of this technical assistance is to engage actors into a future collaborative and cooperative process, encouraging the exploration of previously unseen possibilities allowing for the necessary innovations to the effective implementation of a circular economy in Brazil. Considering that circular economy is still in the early stages of development in the country, this assessment for CE in Brazil allowed the recognition of many players engaged in a broad range of initiatives in circular economy as well as the presence of key actors with potential leadership role.

To support the process of developing a general roadmap, a framework was conceived to offer flexibility and adaptation to include a wide range of scopes, thus including the broad diversity of players engaged in circular economy initiatives in the country and also to consider country's great difference of regional contexts. Taking into account these variations in the future will enable improvements to this result of the assessment of the regional contexts.

In this framework some strategic action areas to the implementation of circular economy projects in Brazil were presented and, from this structure, it is possible to obtain a better understanding of the relationship between players and evaluate their potential influence on public policies, regulatory and fiscal, technological and scientific conditions, and of educational and cultural elements in the country. So, to structure the general roadmap

for a circular economy in Brazil, some strategic action areas were proposed in this framework: (1) Bioeconomy; (2) Urban infrastructure, productive inclusion and regional development; (3) Circular manufacturing and supply chains; (4) Life cycle Assessment and Inventory; (5) Research, Development and Innovation; (6) Low-Carbon Agriculture, and (7) Bioenergy. All of these strategic action areas could potentially impact in the development of a national strategy for the implementation of the circular economy and contribute to the NDC implementation for climate change adaptation and mitigation as well as to the sustainable development goals of 2030 Agenda.

7. Annexes

7.1. ANNEX 1 – Interview Questions for key actors who could potentially be involved in the development of a Circular Economy Roadmap in Brazil

-INTERVIEW QUESTIONS -

Project: Assessment of the current status of the Circular Economy for developing a Roadmap for Brazil, Chile, Mexico and Uruguay

Interview questions to get inputs to build a draft roadmap for a Circular Economy

*These interview questions will be used to gather information to complete the following deliverables: **D2.4.** Evaluation Report, **D3.1.** Report presenting a map of the main economic activities that may be impacted by circular economy initiatives, **D3.2.** Report of the strengths and opportunities identified, **D3.3.** Report of the weaknesses and barriers identified **D3.4.** Report with the indicator matrix

In addition, through some questions, National Consultants may collect information that can be used as an input to:

Output 4- Review of international experiences

Output 5 - Mapping of successful cases of application of industry 4.0 which benefit circular economy at international level and adoption of practices at local level taking into account technological development in these countries.

Output 6 - Identification of potential projects in circular economy prioritizing specific territories

For the development of the roadmap, it is necessary to **understand the experiences of each actor in their field of work and in circular economy** and their commitment to build a circular economy roadmap.

Interviews will be conducted with 5 to 15 actors in each country. The interviewees will be classified in the following five categories: **government/public sector, companies, civil society, academia and entrepreneurs.** Ideally, all of these categories will be covered throughout the interviews. Interviews with international and national leaders in the circular economy will be prioritized.

The results of these interviews **will be recorded** in order to be used throughout the different stages of this consultancy.

*** Some Interview questions must be also focused on the gender perspective to have a diagnosis about the approach that these actors give to this topic**

***The definition of players and processes for consultation and/or to be incorporated in the analysis for the development of the road maps must have the approval of the Designated National Entity (DNE) of each country.**

Country:	
Name:	Date:
Position:	Place:
Organization: <i>* If you are not affiliated with any organization, specify as "independent"</i>	Contact information Email: Phone number: URL:

Sector	Q1. In which category does your organization fit?: <input type="checkbox"/> Government/public sector, <input type="checkbox"/> Companies, <input type="checkbox"/> Civil society organizations, <input type="checkbox"/> Academy <input type="checkbox"/> Entrepreneurs <input type="checkbox"/> other, which _____
National priorities	Q2. From your perspective, which sectors are ready and have the greatest potential to transition to a Circular Economy in your country? <input type="checkbox"/> Manufacture (Technical Cycles); <input type="checkbox"/> Agriculture and Food; <input type="checkbox"/> Natural Resources (Mining, Forestry and Fisheries); <input type="checkbox"/> Construction, Transportation, Logistics and Commerce; <input type="checkbox"/> IT and Smart City; <input type="checkbox"/> Energy, <input type="checkbox"/> Other... Why?
	Q3. Please mention three (3) Circular Economy opportunities in the sectors selected in Question 2

Experience, skills and commitment	<p>Q4. Please describe the TWO most important projects or completed plans related to Circular Economy in which you have participated or are participating.</p> <p>Q5. Please describe your past experiences in Circular Economy projects.</p> <p>Q6. How do you see your organization or yourself involved in future circular economy plans in your country?</p>
Perceived benefits	<p>Q7. What benefits do you think a Circular Economy can bring to the current materials management system in [country]?</p> <p>Q8. Which products/by-products that are currently considered "waste" in [country] would have a high potential to close the cycle in the country?</p> <p>Q9. According to the opportunities identified in Question 3 please tell us:</p> <ul style="list-style-type: none"> - How could we assess economic benefits of a circular economy? - How could we assess environmental benefits of a circular economy? - How could we assess social benefits of a circular economy?
	<p>Q10. What other benefits do you think a Circular Economy can bring to your country (Brazil/Chile/Mexico/Uruguay)?</p>
	<p>Q11. In terms of climate change and sustainable development:</p> <ul style="list-style-type: none"> - Can you mention one or more potential impacts of a Circular Economy to your country's National Determined Contribution (NDC)? [The country's NDCs are attached to this questionnaire] Or you can see them at: https://www4.unfccc.int/sites/NDCStaging/pages/All.aspx - Can you mention one or more potential impacts of the Circular Economy on your country's Sustainable Development Goals (SDGs) in the 2030 Agenda; take into account SDGs 9,12 and 13? You can see the SDGs at: https://www.un.org/sustainable-development/sustainable-development-goals/

Strengths and opportunities	<p>Q12. Provide your point view of your country's strengths and opportunities in adopting a general, sectoral or specific circular economy roadmap, in terms of:</p> <ol style="list-style-type: none"> 1. Industrial, technological and innovation capabilities and infrastructure 2. Recycling, climate change and circular economy policies or initiatives 3. Governance and leadership 4. Non-conventional renewable energy integration level (NCRE) (percentage of energy matrix) 5. Alignment of public and private agendas (government, companies, organizations, academia and society commitment) 6. Job creation 7. Impact on NDCs and SDS in your country 8. The main economic activities of the country that may be most positively impacted by the circular economy.
Weaknesses and barriers	<p>Q13. Provide your point of view of the weaknesses and barriers that your country might face in adopting a general, sectoral or specific circular economy roadmap, in terms of:</p> <ol style="list-style-type: none"> 1. Policy and regulatory framework; 2. Quality of systems; 3. Macroeconomic imbalances; 4. Market (market size and market distortions); 5. Cultural practices; 6. Entrepreneurship support; 7. Financial support and access to financing; 8. Investment gaps; 9. Industry and technology; 10. Research and development; 11. Recovery of products and materials at the end of use
Indicator matrix	<p>Q14. Do you think it is possible to evaluate <u>material flows</u> as an indicator to measure a circular economy? How could you help in this challenge?</p>
	<p>Q15. Do you think it is possible to evaluate the <u>consumption/use of products</u> as an indicator to measure a circular economy? How could you help in this challenge?</p>

	<p>Q16. Do you think it is possible to assess the <u>territorial enabling conditions</u> as an indicator for measuring a circular economy? How could you help in this challenge?</p>
International experiences	<p>Q17. Which criteria do you think is important to consider when selecting successful international circular economy cases that can be compared to your country?</p> <p>Q18. Are there any specific circumstances in your country that you think it is important to consider when selecting international circular economy case studies?</p>
Industry 4.0	<p>Q19. What is the current state of Industry 4.0 in your country? See a description of Industry 4.0 at: https://www.forbes.com/sites/bernardmarr/2018/09/02/what-is-industry-4-0-heres-a-super-easy-explanation-for-anyone/#5b74ce0c9788</p>
	<p>Q20. To what extent is your organization using and developing aspects of Industry 4.0? How do you think Industry 4.0 could add value or make your business more competitive?</p>
	<p>Q21. How can the economic activities identified in Question 2 be improved by incorporating industry 4.0 specific technologies?</p>
Pilot projects	<p>Q22. How can a pilot project add value or facilitate the transition toward a circular economy in your country and sector?</p> <p>Q23. ¿Do you know any circular economy pilot projects that are being implemented in your country / area of expertise / sector?</p>
Gender perspective	<p>Q24. To what extent has the implementation of a circular economy integrated the consideration of gender equality into the design of activities and related material?</p> <p>Q25. How has gender equality consideration been integrated into your organization or field of work? Could you describe any initiatives on gender inclusion on your organization or some organizations you have worked for?</p>

7.2. ANNEX 2 – Answers of the first level survey to identified relevant actors for a circular roadmap for Brazil

A complete database of answers provided to the survey conducted through Google Forms is attached as **an Excel file**.

7.3. ANNEX 3 – Complete list of actors selected for the interviews

*Note: The actors marked in bold are actors who have been interviewed.

Public Sector			
Organization	Contact	Position	Experience / Skills
CETEM – Mining Technology Center	Lucia Xavier	Head researcher on CE	Research and Innovation, full Researcher at the Center for Mineral Technology (CETEM / MCTIC) working in the areas of urban mining and circular economy.
Embrapa Agroenergy	Simone Mendonça	Researcher	Researcher at the Brazilian Agricultural Research Corporation in the area of co-products and waste.
Embrapa Environment	Marilia Foglegatti	Researcher	Researcher at Embrapa Environment linked to the Environmental Management Laboratory. She has experience in food science and technology, focusing on small scale agroindustrialization and food safety, as well as environmental impact assessment and certification. Since 2009, she is working on LCA projects, including LCI and LCA studies of the main Brazilian agricultural commodities, agroenergetic products and complex production systems.
FINEP – Funding Authority for Studies and Projects	Henrique Vasquez Feteira do Vale	Manager on the innovation board.	Manager in the Department of Materials, Chemistry and Environmental Sanitation. It acts in the management of the activities of fomenting the innovation in the industry, elaboration of programs of support to the RD&I, institutional representation and articulation between the key actors of the national innovation system.
IBICT – Institute of Information Science and Technology	Tiago Braga	General-Coordinator of Information Technology and Computing	PhD in Information Science focusing on information networks, Master in Technological Education and graduated in Information Systems. A civil servant working for IBICT, he is currently general coordinator of information and information technology.
Industry Associations			
Organization	Contact	Position	Experience / Skills

ABRE – Brazilian Pack- aging Associa- tion	Luciana Pelle- grino	Executive Di- rector	Experience working on projects, cooperation programs, working groups, conferences, business missions, brochures, toolkits, guide- lines, digital platforms, market research, speeches/lectures, media interviews, trade shows. Building capacity from short term courses in different areas as design thinking, innovation business model, sustainability, coaching, sales at ABRE.
C&A Institute	Margarida Curti Lunetta	Program Man- ager of Circular Transformation	Responsible for the implementation of pro- grams and partnerships in Brazil that shall contribute to the Institute C&A (C&A Founda- tion representative in the country) which has the mission of transforming fashion into a fair and sustainable industry by rethinking ap- parel and moving towards a new kind of in- dustry. An industry that uses and reuses safe materials, makes products "made to be made again", restores and regenerates eco- systems and provides dignified work for peo- ple.
CNI – National Indus- try Confedera- tion	Sergio Mon- forte	<i>Environmental and Sustaina- bility Expert</i>	Responsible for the project management of CNI's Environment and Sustainability Man- agement, the coordination of CNI's Sustaina- ble Production and Consumption Network and the institutional representation in coun- cils, events and meetings, in order to ensure the defense of the industries interest and keep the entity updated on topics related to the theme in Brazil and worldwide through in- teraction with industry federations, industry sector associations, Federal Government and partners.
Civil society organizations			
Organization	Contact	Position	Experience / Skills
Akatu Institute	Fernanda Yumi Iwasaka	Analista de Conteúdos e Metodologias	Master in the Graduate Program in Produc- tion Engineering at the School of Engineering of São Carlos (EESC-USP) in the area of Inno- vation and Sustainability with the work "Pub- lic policies and circular economy: interna- tional listing and evaluation of national solid waste policy". Public Administrator at Pau- lista State University (Unesp).

Tearfund Brasil	Simone Vieira	Advocacy Co-ordination	Advocacy work for influencing the formulation, approval and execution of public policies by the legislative, executive and judiciary branches and society, through networking and the mobilization of the media for a fair and representative democracy, which strengthens the participation of different social actors in public interest debates.
IABS	Camila Acioli Marinho	Consultancy and technical support	Technical consultant on circular economy at the Brazilian Institute of Development and Sustainability - IABS, and Master's student in environmental technologies at the Federal Institute of Alagoas with a line of research focused on eco-innovation.
Ellen MacArthur Foundation	Luisa Santiago	Latin America Lead	Leading the work of the Ellen MacArthur Foundation in Brazil, aiming at accelerating the transition to a circular economy in the country in collaboration with companies, emerging innovators, governments and academia. Over 7 years of experience in consulting in strategy & sustainability, working with clients from different sectors like industries, governments and the non-profit organizations. Main areas of expertise: sustainability, strategy, circular economy, city resilience, environment health and safety.
Academia			
Organization	Contact	Position	Experience / Skills
EESC/USP - University of São Paulo	Prof. Dr. Aldo Ometto	Professor and Researcher	Professor at the University of São Paulo. Coordinator of CNPq's Research Group on Life Cycle Engineering and Management, member of USP's Advanced Manufacturing Center. He was coordinator of USP's Pioneer University Program in Circular Economy (EC) with the Ellen Macarthur Foundation.
USP – University of São Paulo	Prof. Dr. Ricardo Abramovay	Professor and Researcher	Professor of the Department of Economics at FEA / USP for three years. Full Professor since 2001. Currently, Senior Professor of the Environmental Science Program of the USP Institute of Energy and Environment. Author of Amazonia: For a Knowledge of Nature Economy (Elephant / Third Way / Other Words. Author of Beyond the green economy (Ed. Sustainable Planet / April, Sao Paulo, 2012), reviewed and published by Routledge (London) in 2016.

COOPE / UFRJ – University of Rio de Janeiro	Prof. Dr. Ro- mildo Toledo	Professor and Researcher	Associate Professor at the Federal University of Rio de Janeiro. He has experience in Civil Engineering, focusing on concrete, acting on the following subjects: concrete, composite materials, low environmental impact materials, solid waste (urban, construction and demolition, agricultural and industrial), bio-materials.
COPPE/UFRJ - University of Rio de Janeiro	Prof. Dr. Alex- andre Szklo	Professor and Researcher	Associate Professor at the Energy Planning Program in the Graduate School of Engineering of the Federal University of Rio de Janeiro (COPPE/UFRJ). Chemical Engineer at UFRJ. Focus on energy economics, energy matrix, cogeneration, biofuels, oil refining and the oil and oil products market in the areas of energy, environment, chemical engineering and climate change.
Entrepreneurs			
Organization	Contact	Position	Experience / Skills
Ideia Circular	Carla Tennenbaum	Co-Founder of Ideia Circular	Co-Founder of Ideia Circular to disseminate the concept of a circular economy, cradle to cradle and circular design in Brazil, and promote innovative local and international projects. Member of the Expert Working Group of CEP-Americas - Circular Economy Platform of the Americas. Designer specialist in art, co-creation, creative facilitation, crafts development, product design, graphic design, design consultancy, research and development.
CICLA	Daniel Car- valho	Specialist in the Recycling Mar- ket	Project Manager, research and develop-ment in the area of recycling, reverse logis-tics, circular economy and recycling market. He works in the area of consulting / advisory in social environmental development pro-jects, strong performance in the project de-velopment for social inclusion of waste pick-ers, social / inclusive business and local de-velopment.
Exchange 4Change	Beatriz Luz	Founder of Ex- change 4Change	She supports organizations to re-think their business models, re-design products and process and gain competitive advantage through the circular economy mindset and strategies.

7.4. ANNEX 4 – Answers of the second level survey with key actors for a circular roadmap for Brazil

In the table below is presented the highlights from the responses of the selected key actors that have participated in the interview process. *The interview questionnaire is presented in Annex 1.*

Q1 – Sergio Monforte, Environmental and Sustainability Expert at National Industry Confederation, CNI
Q2, Q3 – In Brazil, electronics, textile, paper and cellulose and cement industrial sectors have a lot of potential to develop CE models. Also, packaging, cleaning and steel sectors are giving some interesting steps, and many others.
Q4, Q5, Q6 – In 2014, most of our efforts were on waste management and regulations. In 2017 we start to understand more about the circular economy potential in new business models, improve supply chains, job creation, industry 4.0. Also, the CE embraces current efforts in cleaner production and efficiency. In 2019, we realized that even though the companies do not perceive the CE concept, many of them have some sort of CE initiatives in practice. Also, they agree that the CE may be important to competitiveness. We have just released the CE Strategic Map for Brazilian Industry with 5 main priority areas to act on: Policies, Education, R&D+I, Financing and Market. There is a growing potential to CE in Brazil, especially for formalization and job creation, new business models and improvements in supply chain. Government is starting to support efforts in this topic, like we saw in our last CE meeting this year.
Q7, Q8, Q9, Q10 – The idea of “taken the most use of materials” is something that is already in the “DNA” of industry. First companies started to improve efficiency inside their business, now, with the CE approach they will look for efficiency in the whole supply chain. The challenge is to improve the long-term vision of benefits and to create a market for 2nd cycle materials vs. virgin material. But to make it really happen the collaboration of many actors is needed and between different sectors.
Q11 – CE is transversal to the SDGs and NDCs. It may positively impact GHG emissions. It also may improve sewage systems, with potential impacts on public health. The SDG 12 is more easily related but CE may have a role to improve many other SDG’s. Above all is important now “what is the CE model to Brazil?” and start to measure and communicate the CE benefits.
Q12, Q13 – The roadmap success may depend on the capacity to articulate and engage the many actors enrolled, mapping its interests and needs, and establishing more effective partnerships. The risk is to no gain the credibility needed to build trust among the actors and support a “go to action”. To this aim, align with the broader agenda of industry is very important.

Q14, Q15, Q16 – Designing CE indicators for the industry is a worldwide work in progress. To this aim, we are leading part of the efforts from Brazil to contribute to the ISO standard for the CE under construction.

Q17, Q18 – The more we can get from different cases for benchmark, the better. Not just from EU but also from China, and LatAm countries like Mexico, Chile, Uruguay and others.

Q19, Q20, Q21 – The Ind 4.0 impacts are not easy to address. We have a group in the CNI dedicated to this specific topic. There are many regional and sectorial challenges to this issue.

Q22, Q23 – Very promising Pilot Projects on Industrial Symbiosis (in Minas Gerais), WEEE recycling, and using Urban Solid Waste for co-generation of energy for cement production are in progress.

Q24, Q25 – Gender equality is very important. Although it is not clear how the CE relates to this topic, the material flows have consequences that may indirectly affect gender equality like: formalization, job creation, value of waste, innovation and energy.

Q1 – Henrique Vasquez, Manager on the Innovation board at the Research and Innovation Financier, FINEP

Q2, Q3 – Although the Solid Waste Residues issue is very important in Brazil, the discussions around this topic are not exploring the CE. Another important topic is Sanitation, from manifold perspectives like improving the water value perception and innovate water systems to avoid leakages and sewage treatment turning into nutrient recycling systems. In addition, there's a great vocation for the CE biocycle in Brazil, mostly to take advantage of renewable resources in form of biomass, biofuels and biosynthetic. The bioeconomy, applied to agroindustry and biochemical industry for instance, Brazil may take advantage in this global newborn market, also because the country has a lot of developed capacity on this field.

Q4, Q5, Q6 – The experience coordinating the public notices, the international consortium ERA-MIN and the call for Startups, taught us the CE is one main trend that we need to incorporate. This led to an approximation with the National Confederation of Industry, CNI, as we supported their event on CE this year. In the future I believe that is important to encourage the creation of a multi-stakeholder group to boost CE efforts in Brazil, and I expect that the roadmap could point to this direction.

Q7, Q8, Q9, Q10 – the CE in Brazil has the potential to bring benefits in many environmental issues like climate change and soil contamination and also boost the adoption of Biomaterials. It may impact also civil construction. Shared models on CE may improve transportation and logistics efficiency. One important question is to what extent the CE in Brazil will consider the participation of recyclers cooperatives and the need of cultural and intangible changes. It may be interesting to say that on the evaluation criteria in ERA-MIN was the acceptance and behavior changes wanted in the innovations applied to the call.

Q11 – The relation between SDG's, NDC's and the CE is huge. CE systems, especially in the biocycle "regenerative" approach, to water, food, energy, and others, may deliver direct and indirect benefits to every SDG and the Climate Change efforts.

Q12, Q13 - The CE approach is under construction. The creation of a roadmap has the potential to bring together many different stakeholders and build a shared vision of CE to Brazil. The challenge is to make a good articulation between the actors and organizations, to make sure that it will continue afterwards. The main difficult is surely to conduct the articulation, coordination and integration of efforts among the actors within the group in the long term

Q14, Q15, Q16 – Unfortunately we have no CE indicators to follow and measure the evolution of a project. We have only used some criteria to select the projects within the public call. I do not know any companies with CE metrics in use. In Brazil, many of the current quantitative indicators for efficiency are not even measured. Some companies may measure the material flows in simple input-output model.

Q17, Q18 – You can choose benchmarks to Brazil by the level of efficiency and impact delivered. The cases should account for the many different applications of the CE. Brazil need initiatives that are capable to be scaled, to the regional level. You need to decide from where is feasible to start from, as we have regions in Brazil with very specific characteristics like the north region, Amazonas.

Q19, Q20, Q21 – The industry 4.0 will bring technologies to enable the CE like: IoT, additive manufacture, etc. In Brazil, most of the initiatives are looking for improvements in waste reduction and reverse logistics. In the future we may have embedded technology in products that may create new CE markets, like for product-service systems.

Q22, Q23 – The pilot projects are a very important way to accelerate innovation in CE to Brazil. Currently, I'm not following any innovative Pilot on CE in Brazil, but I know about some industrial symbiosis being developed in Minas Gerais.

Q24, Q25 – Gender equality is a need for any approach to the future and CE is one of them. I know that ERA-MIN has some criteria for gender equality in the process, and I believe the CE roadmap should also have this kind of criteria.

Q1 - Carla Tenenbaum, Designer and Co-Founder at Ideia Circular

Q2, Q3 – There's an opportunity to make some important changes in the way Design is learned and applied, opposing to the minimization way of thinking and contributing to balance industrial development and environmental preservation. Textile and Agriculture are some interesting sectors to apply these ideas.

Q4, Q5, Q6 – Art and Design with discarded materials are a powerful way to impact in the local, small scale communities and create space to communicate the new CE values and influence how people perceive the materials, influencing cultural changes. Efforts to disseminate the circular economy principles through education have also the potential to change the mindset in the industrial design approach. The challenge is to avoid wearing down the term "circular economy" and keeping its meaning relevant and inspiring.

Q7, Q8, Q9, Q10 – CE is a model, and not just a tool. It's a vision of how the industrial system can be a force for good and these changes are made through design. Applying the CE design approach one can impact on reducing extraction and pollution of ecosystems as well as keep most of the product value for longer time. This approach can also bring resilience to macro and micro economic levels. Finally, by designing with health and safe materials, one can protect workers and public health in general and avoid risks related to toxicity.

Q11 – SDGs and NDC are not in my field of work, but I believe that the SDGs have improved the adherence to CE by tackling the issues related to sustainable production and consumption and the aim of economic growth without harming the environment. Also, regarding climate change mitigation, CE brings a new perspective to efforts to improve the "GHG cycling" beyond just reducing GHGs.

Q12 – The CE roadmap may help to better articulate the industrial sector to the others related to materials management. But to be effective it has to understand the context from the recycling cooperatives perspective to challenge the way we think waste management. Above all, is essential that the CE roadmap introduce a "transformative vision". The risk is to simplify too much the CE concepts, in a way to be too comfortable to organizations have the feeling that they already do it in their current limited efforts. Because most of the time the industry is driven by a short-term vision and policies are based on a linear economic approach, it is very important to set up ambitious criteria to characterize what is a genuine CE materials management.

Q14, Q15, Q16 – Measuring the adoption of renewable energy may be easier to be quantified. In the other hand, the Cradle-to-Cradle Product Certification may help to set up criteria for circularity, especially to evaluate materials health and recyclability materials index. It is important to have in mind that the Brazilian cultural context may be good for setting up commercial systems for product reuse, refurbishment and sharing, but, at the same time, studies have already shown that changes in tax mechanisms are needed to support the recycled materials market and encourage innovation.

Q17, Q18 - Benchmarks on CE to bring to formality the informal activities are needed. The European materials recovery systems probably do not apply to Brazil, technological solutions are in most of the cases too expensive to our context. Solutions in India and other Latin American countries, which has to incorporate the informal workers and value their activities into materials management supply chains, may be of the most use for Brazil. Also, would be interesting to have cases showing CE options for the industry based on exporting commodities.

Q19, Q20, Q21 – Not specialized in this field, but I believe that the Ind. 4.0 will impact a lot on products traceability for materials recycling and the reuse of products.

Q22, Q23 – Pilot projects are great ways to test new solutions to initiatives and topics that would not be supported by the usual means. SMEs can benefit from it as well as big companies may use it as test bed for open innovation.

Q24, Q25 – Many women are enrolled in CE leadership, like Ellen Macarthur and us in Ideia Circular. "Circular is metaphor for Feminine": the idea of an industrial production that "cares" about the environment and people is very feminine. How to bring the "take care" approach for the leadership and decision-making positions, most of them occupied by men?

Q1 – Daniel Carvalho Specialist in the Recycling Market and co-Founder at CICLA

Q2, Q3 – It is an opportunity to formalization of informal activities around waste management. CE is a new approach in the field of the Recycling "movement" that will impose changes in the long term, because it has the support of industry.

Q4, Q5, Q6 – Curitiba is one of the pioneers on the cooperatives for recycling formalization. The National Movement of Material Recyclers (MNCR) is the great social organization on this field. The Coca-Cola Co. has developed indicators to manage the evolution in the relations with partner cooperatives.

Q7, Q8, Q9, Q10 – From the point of view of the lowest income recyclers, the CE brings no benefits.

Q11- The NCD and SDGs becomes marketing, with very low practical results.

Q12, Q13 – Brazil has a very diverse and fertile context to experimentation and can deliver cases that could impact abroad. But the taxation structure and other regulations supports solutions in the linear model – dump, landfilling and incineration - and prevent the improvement towards the CE perspective

Q14, Q15, Q16 – Measuring the increase of percentage of what it is formally recycled, by accounting the fiscal sheets of companies, as well as measuring the closure of open dumps and the reduction in the volume of waste toward landfills may be three indicators useful to know the evolution in keeping materials in the production system.

Q17, Q18 – In the Brazilian context, it would be good to look for benchmarks on alternative models for social inclusion of informal waste pickers, and benchmarks on new taxation models for materials looking for ways to extend the responsibility on materials and products.

Q19, Q20, Q21 – The Ind. 4.0 technologies will probably solve most of the problem for materials recover and waste and this will be associated to unpredictable social consequences, good and bad ones. Government will face a lot of difficulty, in most of cases, will probably not be effective to regulate all the changes that will come.

Q22, Q23 – Pilot Projects are an effective way to trial and learn from doing. In Brazil you may face difficulties in the development of pilot projects with waste pickers and cooperatives to recover wasted materials because there's a lobby against innovation in this sector.

Q24, Q25 – Currently there is no correlation between Gender Equality and CE. Most of technological development is dominated by the presence of men. In the other hand, around 70 % of recyclers in cooperatives are woman. Summing up, there are no efforts in putting this topic into the debate of recycling context in Brazil.

Q1 - Aldo Ometto, Professor and Researcher at University of São Paulo, EESC/USP and RC4CE

Q2, Q3 – CE is bringing Important changes to education, for instance in Engineering, macro and microeconomics and other fields. Also, research in specific sectors in Brazil like Textile, Plastics and electro-electronics - the frontrunners of CE in the country - and Agroindustry - despite the fact it will probably be more resistant to change - have lot of potential with the CE.

Q4, Q5, Q6 – The RC4CE Research Center for Circular Economy at USP is bringing many industrial sectors together, partnering with CNI, developing the capacitation and finding opportunities in CE for companies. RENNER and HP / Sinctronics are the first of the companies that already have made efforts in this direction. We need to enroll more actors like the Waste Recyclers Cooperatives, and from government to change regulations that are barriers to changes to enable CE.

Q7, Q8, Q9, Q10 – Transition starts by changing the vision in the mindset – by companies and consumers. The big challenge is government policies and regulations, like double taxation to recycle materials and other existing barriers to CE systems. CE in LatAm has to deliver social benefits, but not just to assist basic needs, but creating opportunities by valuing the residues in the market. In the Agroindustrial systems, integrating food, energy and nutrient cycling has huge potential, and have some cases in Brazil, like in the sugarcane production.

Q11 – Changing the Energy Matrix to renewables, as something that is essential to every circular economy system to be sustainable, may be the most important issue to deliver improvements to the NDCs and SDGs.

Q12, Q13 – The roadmap has the opportunity to become a reference for the actors in the different areas to understand their role and identify a shared vision for CE in Brazil, from the cooperatives of waste pickers up to the companies. This is important for understanding the different roles and finding ways of cooperation and coordination between them. To be effective, the roadmap for an EC must focus on the necessary social and cultural changes - consumption, management, policies and systems of cooperation - at the risk of not being useful or practical if it becomes just a 'technology roadmap' with a too technical approach.

Q14, Q15, Q16 – Just has duplicated a scientific paper to CE indicators in social, environmental and economic, applied to plastics, textile and electro-electronics industry. The Measuring the amount of renewable materials we are using in the production is important. Also measuring the consumer perception on Circular Economy may indicate in what level this will drive the market, as well as measuring the trend in the adoption of circular business models. Is important also to measure, somehow, the effectiveness of current a new policy (like for waste management) and technologies (like public infrastructures. Finally, to measure the impact to create quality jobs is of the most importance.

Q17, Q18 – Is desirable to look for benchmarks to the most prominent sectors for the CE in Brazil (like electro-electronics, textiles and agroindustry) as well as the less “circular” sectors (like mining and commodities in general).

Q19, Q20, Q21 – 90 % of companies in Brazil are SME's and or companies not prepared to the Industrial 4.0 technologies. So is very important to improve the basic knowledge in management to most of companies in Brazil to prepare them to this revolution. Government will have very limited control to regulate changes that will impact reality very fast. Above all, the social impacts, specific for jobs, are not well understood, so approaching Circular Economy concepts together with Ind. 4.0 may be “too much”.

Q22, Q23 – In Brazil, Pilot Projects may be of very importance to add value to the Agri industrial potential to create an Energy and food nexus as well as nutrients circulation to regenerate soil. Also, pilot projects for sectors that may deliver the most of social benefits are very important to the Brazilian context.

Q1 – Beatriz Luz, Consultant and Founder at Exchange 4Change, E4C

Q2, Q3 – Packaging, Textiles and Household appliances are main areas that the CE main deliver many business opportunities.

Q4, Q5, Q6 – Steel production are show a lot of potential to primary industrial sector in Brazil. Another initiative is a hub for multi-sectorial collaboration to foster CE solutions.

Q7, Q8, Q9, Q10 – CE offers a new business perspective to companies gain competitiveness, gain market differentiation, reach compliance and lower risks in resources, regulation and costs. The CE projects put the different departments inside companies to work together. Above all, companies can't wait for regulations and policies to start investing in CE.

Q11 – CE is totally related to the SDGs and NDC's. New CE business models can help to reach goals and targets. In the EU, the CE is now in the center of the “Green New Deal” strategic plan. Companies may keep growing but in a different way.

Q12, Q13 – Having a CE roadmap to Brazil should present a critical analysis of the scenario and a positive vision for the future. The risk is to not be able to bring all actors from all sectors together.

Q14, Q15, Q16 – Globally, the development of indicators to measure the CE are just beginning, as we can see in the CE ISO Standard discussions. There are indirect indicators that could indicate the outcomes from a CE business models like job creation and waste reduction. One question is how to apply CE metrics in the different scales of the systems. I believe CE indicators must combine different indicators, including subjective ones.

Q17, Q18 – Benchmarks may show how companies cooperate to scale innovations, to introduce new materials and create new supply chains, to create new service systems and remanufacture business models, etc.

Q19, Q20, Q21 – The Ind. 4.0 has the potential to accelerate CE implementation, as is already seen in new companies and innovative business models. In Brazil, CE and Ind. 4.0 may be implemented together to deliver gains to companies.

Q22, Q23 – As Brazilian companies do not have a culture of innovation, implementing CE pilot projects in Brazil are essential to present tangible results of the concept. The many different regional contexts may impose a challenge to this aim. Sintronics is a very well succeed pilot project in the WEEE industry to learn from.

Q24, Q25 – In COP25 was clear that many of the global leaders in CE are women, and also in Brazil. I believe that women bring a “fresh perspective” for the CE exactly because, women were mostly an outsider of the linear economic systems.

Q1 - Tiago Braga, General Coordinator of Information Technology and Computing at the *Institute of Information Science and Technology, IBICT*

Q2, Q3 – For Brazil, Circular Economy represents a great opportunity for advances in the energy matrix for the production of products, as a competitive differential for Agribusiness and as a basis for waste management in the electro-electronic sector.

Q4, Q5, Q6 – So far, the Circular Economy is a field more restricted to the academic environment, which has been approached in a more generic way. On the other hand, the CE offers an advantage to influence product marketing because it has the potential to communicate sustainability issues related to products and production chains in a positive and more superficial way, without having to go deeper technically. However, in the future, a “professionalization” of the CE is necessary, expanding scientific and professional knowledge on the subject.

Q7, Q8, Q9 – In Brazil, the recycling sector is quite advanced in some areas. One of the great challenges is to move forward to create more opportunities for professional inclusion in this market.

Q10, Q11 – The debate on environmental sustainability is a topic that is very much in evidence. However, I believe that it is still difficult to assess the effective contribution of the Circular Economy to the NDCs and SDGs.

Q12 – There are opportunities to enhance the "sustainability profile" for the country and thus consolidate this profile for all national productive sectors, so that Brazilian products have a differential. A strong feature of the Brazilian context is the existence of an information analysis infrastructure to quantify the CE, for example with the databases and software available for Life Cycle Assessment, and the performance of organizations such as INMETRO, CEBEDS, ACV Brazil and CNI.

Q13 – There are threats and barriers related to the country's political instability, which can promote setbacks in the direction that is positive for the CE today. A weakness of the country's context is the economic difficulties that the industry has been going through, especially so that it can modernize to provide the Circular Economy. In this situation "it is difficult to open up to the new, when you are still concerned with old issues".

Q14, Q15, Q16 – I do not know of existing indicators to measure more subjective and long-term issues to assess CE at the territorial level. On the other hand, there are already useful indicators for CE capable of analyzing more short-term issues related to the flow of materials and consumption, such as the various impact analysis indicators of the LCA method, which may also include more traditional metrics, grounded in this same approach.

Q17, Q18 – The Circular Economy is under construction worldwide. Experiences related to greater adoption of Clean Energy in related processes to increase the viability of CE are important for the Brazilian national context. Also, in the social area, Brazil is in moment with an increase in the population in a situation of vulnerability, and that is why examples are important where the CE demonstrates its potential in this field.

Q19, Q20, Q21 – In Brazil, I believe that there are already examples of sectors taking actions towards Industry 4.0. The Circular Economy could help to reinforce and promote the benefits of Ind. 4.0 for these and more sectors. I believe that the CE can be a drive to advance the technological modernization of the national industry.

Q22, Q23 – Pilot projects are important to collect data and validate possible paths to the Circular Economy in the country. In particular, projects will be relevant for the Electrical and Electronics sector, where there are already prominent cases in the country, and also for the plastics sector.

Q24, Q25 – As far as I know, the Circular Economy model does not directly concern gender equality. However, I believe that this movement of change caused by the CE can open opportunities and favor the debate on issues related to this theme.

Q1 - Prof. Alexandre Szklo, COPPE UFRJ, part of the team of UNDP - Technology Needs Assessment and Technological Action Plan, for Brazil.

Q2, Q3 – The CE is a field for the application of Ind. 4.0 technologies. There are opportunities in the whole Processing Industry segment, regarding its waste generation problem, by waste recovery. Specific sectors like Chemical Industry and Textile industry are some examples.

Q4, Q5, Q6 – Most of my professional experience are in indirect areas related to the CE, like industrial symbiosis, chemistry and energy. I see professionals in the field of Environmental Sciences, Materials Flow Assessment, Life Cycle Assessment and Green Chemistry more dedicated to relating their work with the CE. In my field of research, the CE is understood as a competitive advantage for the industry, especially for Climate Change mitigation. The CE is a new “vision” to help a more sustainable industrial development. Through Green Chemistry, for instance, industry is developing innovative materials and production processes that generate “negative emissions” of GHGs, and waste from these processes are to integrate CE systems. In the case of Brazil, the field of biomaterials and renewable resources are of most prominent areas to be developed.

Q7, Q8, Q9, Q10– Every material is potentially a circular economy material, and this includes materials that loses its quality with the recover processes (through ‘cascading’). To make CE viable, the advances in Industry 4.0 will specially be important to the growing need of data and information management. Social benefits of CE come from improvements in sanitation, especially for reducing industrial waste. This is also an environmental benefit as well as the reduction of GHG emissions. Economic benefits need to be evaluated regarding the best viable cost possible. The CE processes not always brings economic advantages without adding the externalities.

Q11 - Regarding the NDCs and SDGs, I believe that the NDCs are already in the SDG for Climate Change Mitigation. CE brings much more tangibility to SDGs dedicated to issues regarding industry and CE is transversal to impact in many other SDGs, like the ones related to water, health and biodiversity.

Q12 – Abroad, the CE is opening many opportunities to more sustainable global supply chains, with green chemistry for instance and currently, unfortunately, Brazil is not moving together in this direction. In the work of the TNA (UNDP Technology Needs Assessment) the CE is positioned as a drive to guide the efforts regarding Industry 4.0 technologies and processes.

Q13 – Currently, Brazil is suffering from deindustrialization process, our industrial park is old and we have not enough investments capacity. Also, the governmental plan for industrial development is not being implemented and we lack of coordination between the different levels of public administration in federal, state and municipal levels. So, the main threat to Brazil now is to not turn this situation and worse, aggravating this picture.

Q14, Q15, Q16 – Indicators made to monitoring the Ind. 4.0 may be applied to indicate CE and Industrial Symbiosis, like: indicators regarding hardware and software innovation and infrastructure; indicators regarding taxes and regulations; and indicators regarding the flow of information and data security.

Q17, Q18 – As I am not an expert in CE, I do not have much to contribute with criteria for CE international benchmarks.

Q19, Q20, Q21 – I believe that cases regarding data and information security is one of the most important benchmarks for Ind. 4.0 related to CE.

Q22, 23 – I do not know Pilot Projects about CE, because this is not my field of work. But I believe that may have many on Industrial Symbiosis in China, and maybe also in Brazil. Pilot projects are essential to support CE implementation, but, in the case of the continuous materials flows of the CE, the challenge is how to set up the right “space and time” of the Pilot Project. There's a risk of a Pilot Project focused in a cluster or industrial processes to turn into an Industrial Symbiosis experiment, and not a CE one. In the work of UNEP TNA for instance, the Ind. 4.0 Pilot Projects are related to a certain technology, e.g. precision agriculture, and this is a good way to guide CE Pilot Projects as well. As an example, CE Pilot Projects could be oriented by technologies for CE product-service systems.

Q24, Q25 – As gender equality is not my field of work, any opinion from my side will be too much speculative, although I believe that CE can impact positively in many aspects in this matter like health energy, water and others.

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