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# Circular North America: Accelerating the Transition to a Thriving and Resilient Low-carbon Economy



November 19, 2020

**DISCUSSION PAPER**

Discussion Paper:

## **Circular North America: Accelerating the Transition to a Thriving and Resilient Low-carbon Economy**

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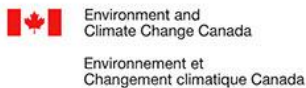
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# Acknowledgements

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- ❖ **Ellen MacArthur Foundation**
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# Executive Summary

This Discussion Paper is designed to stimulate dialogue at upcoming World Circular Economy Forum side events being organized by Environment and Climate Change Canada, the United Nations Environment Programme, and project partners, to inspire an action agenda focused on accelerating the long-term transition to a circular economy in North America.

## *The Circular Economy as a Framework for Prosperity*

The circular economy model has come to the forefront as a solution for moving away from today's linear 'take-make-waste' society, addressing growing environmental and social challenges and risks while generating significant economic benefits. Defining the opportunities for North America will require an understanding of where things are today, what the end goal is, and how to get there – identifying relevant natural resource industry strengths while leveraging service-based sectors and the broader innovation ecosystem.

## *North America's Starting Place*

The following unique characteristics and strengths provide a foundation for North America's circular economy transition:

- **Industrial base and natural resource strengths:** The industrial base varies by country, as well as geographically by region. Manufacturing, the technology sector, and natural resource industries are major economic drivers. The scarcity of resources is less likely to be the primary motivation for the circular economy in North America. Instead, innovation in areas such as the bioeconomy, mineral and metal recycling, and secondary manufacturing and remanufacturing present some of the largest growth potential.
- **Population density and geography:** North America's relatively low population density has created unique challenges in terms of the cost of doing business and the investments needed to support the required infrastructure and service delivery models of the circular economy
- **Culture and mindset:** Despite high consumption and waste generation trends, North America has a strong foundation for accelerating an inclusive circular economy by building on its diverse cultures.
- **Underlying infrastructure:** North America sees an inconsistent and often insufficient level of infrastructure required to support the circular economy. Infrastructure gaps can allow jurisdictions to "leapfrog" the traditional waste management system and focus more on the upstream components of material flows in areas such as product redesign, reuse, repair, remanufacturing, and enhanced recycling.
- **Innovation and corporate leadership:** The innovation ecosystem in North America is well-advanced, with corporate leadership on key issues and applied research in areas that include synthetic biology, material innovation, artificial intelligence, digital platforms, and more.
- **Policy, governance, and jurisdictional control:** The political and governance structures, as well as jurisdictional controls across North America, are varied and complex. While policy leadership on circular economy is growing at all levels of government, more is needed to ensure alignment and harmonization across the region.

## Accelerating the Circular Economy in North America

Accelerating a circular economy in North America will require changes to business models, practices, and policies. Key barriers to be addressed include:

- Cost challenges compared to the extraction and linear use of materials and natural resources;
- Lack of harmonized policies, standards, and frameworks;
- Siloed approaches across sectors and within industries, including insufficient ‘systems thinking’; and
- Gaps in innovation, technology, infrastructure, and financing.

A focus on four key drivers can support the transition in North America: partnerships, policy, innovation, and investment. Enablers within these areas are listed in Table ES1. The key drivers and enablers must be considered as an interconnected system rather than as separate pillars when looking to address the challenges and achieve success.

**Table ES1:** Key drivers and enablers for accelerating the circular economy in North America.

Partnerships	Policy	Innovation	Investment
<ul style="list-style-type: none"> <li>• Cross-sector, Cross-jurisdictional Collaboration</li> <li>• Education and Workforce Development</li> <li>• Better Access to Information, Data and Metrics</li> </ul>	<ul style="list-style-type: none"> <li>• Regulation</li> <li>• Economic Instruments</li> <li>• Procurement and Decision-Making Tools</li> </ul>	<ul style="list-style-type: none"> <li>• Research and Development</li> <li>• Technology Innovation</li> </ul>	<ul style="list-style-type: none"> <li>• Financing</li> <li>• Infrastructure</li> </ul>

Source: The Delphi Group, adapted from Closed Loop Partners

## In Summary

Moving away from the current linear model and transitioning to a circular economy does not look to close doors to international trade, but rather allows more value to be captured from the region’s natural resources and materials, reducing losses by keeping these resources circulating longer in the economy and recapturing their value at the end of a product’s lifetime. It can also help to support climate action in alignment with established climate change mitigation goals and targets.

While moving to a world with minimal waste will present formidable challenges, the current COVID-19 pandemic shows that innovation and collaboration are essential when it comes to addressing global crises, and that transformation can happen when collective minds are put to the task. The same can apply for the circular economy transition, which, if successful, will create a thriving, resilient, and inclusive low-carbon economy for North America.

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# 1. Background

The Government of Canada is hosting the World Circular Economy Forum (WCEF) in Toronto from September 13 to 15, 2021 – an event that will be co-organized by Environment and Climate Change Canada (ECCC) and Sitra, the Finnish Innovation Fund.

To build momentum leading up to WCEF 2021 and to open up discussions between key stakeholders on the opportunities, issues, and challenges associated with advancing North America's circular economy transition, ECCC and the North American office of the United Nations Environment Programme (UNEP) will co-convene two side events – one in November 2020 and the second in March 2021.

These two 'Circular North America' side events are being organized in collaboration with the Circular Economy Leadership Coalition, the Ellen MacArthur Foundation, and MIT Solve, and are designed to connect the community of actors across the ecosystem, drawing insights from and building on the outcomes from a few notable earlier events, including the:

- Great Lakes Circular Economy Forum (Toronto, June 24-26, 2019)<sup>1</sup>
- GLOBE Advance 2020 Workshop on Advancing a Circular Economy in Canada (Vancouver, February 13, 2020)<sup>2</sup>
- Journey to a Circular Economy in the Canada-U.S. Region Session (WCEFOonline, September 29, 2020)<sup>3</sup>

The Delphi Group was commissioned to undertake research and develop a Discussion Paper (i.e., this document) to set up the dialogue at the two Circular North America side events. As part of this effort, Delphi engaged a number of subject-matter experts and regional stakeholders through targeted interviews to gather input and refine the themes and focus areas of the Discussion Paper, as well as shape the questions that will guide the discussion at the two side event sessions.

It is hoped that the outcomes from these side events will result in an action agenda for North America in the lead up to WCEF 2021 and beyond, coalescing key players and helping to accelerate the transition to a thriving and resilient low-carbon circular economy across the region. Note that the Discussion Paper will be updated following the side events to reflect participant input and outcomes from the dialogue.

## 2. The Circular Economy: A trillion-dollar opportunity

Every year, more than 100 billion tons (U.S.) of raw materials globally are transformed into new products. At the same time, only 8.6% of the planet's materials and resources used for these products are cycled back into the economy at the end of their use.<sup>4</sup> Two-thirds of these materials end up dispersed into the environment as unrecoverable 'waste' or pollution – garbage into landfills, plastics into the oceans, carbon dioxide (the 'waste' byproduct from burning fossil fuels) into the atmosphere.

This linear 'take-make-waste' economy puts pressure on the Earth's natural ecosystems and exacerbates social inequalities as a result.<sup>5</sup> It also presents enormous lost economic opportunities from failing to recapture the value of these material resources. Globally, roughly a third of all food is wasted at an annual value of nearly USD 1 trillion dollars.<sup>6</sup> In Canada alone, the value of food lost or wasted every year has been estimated at CAD 49 billion.<sup>7</sup> In the United States, it is estimated that USD 10 billion per year worth of materials enter landfills across the country.<sup>8</sup>

### *The Circular Economy as a Solution to the Current Resource Crisis*

The circular economy model has come to the forefront as a solution for moving away from today's linear society and for addressing the growing environmental and social issues and risks. The circular model is also generating new economic and employment opportunities, creating more resilient communities and businesses, and spurring innovation and new investment. The vision of a circular economy – which optimizes the use of resources and looks to recover and cycle materials through our economy indefinitely – is inspiring many to action.

In the last half century, while the world's population has more than doubled, the amount of material flowing through the economy has more than tripled. Over the last several decades, a societal culture that favours convenience and 'disposability' has evolved. This culture, combined with an expanding population, technological productivity enhancements, the globalization of supply chains, and the sub-optimal functioning of recycling infrastructure and markets, are root causes of the issues.

The circular economy, in turn, seeks to decouple finite resources from economic activity and long-term wellbeing. The model aims to design out waste and pollution through upstream interventions, keeping products and materials in use at the highest value possible throughout their lifetimes, while regenerating natural systems.

### *Key Principles of the Circular Economy*

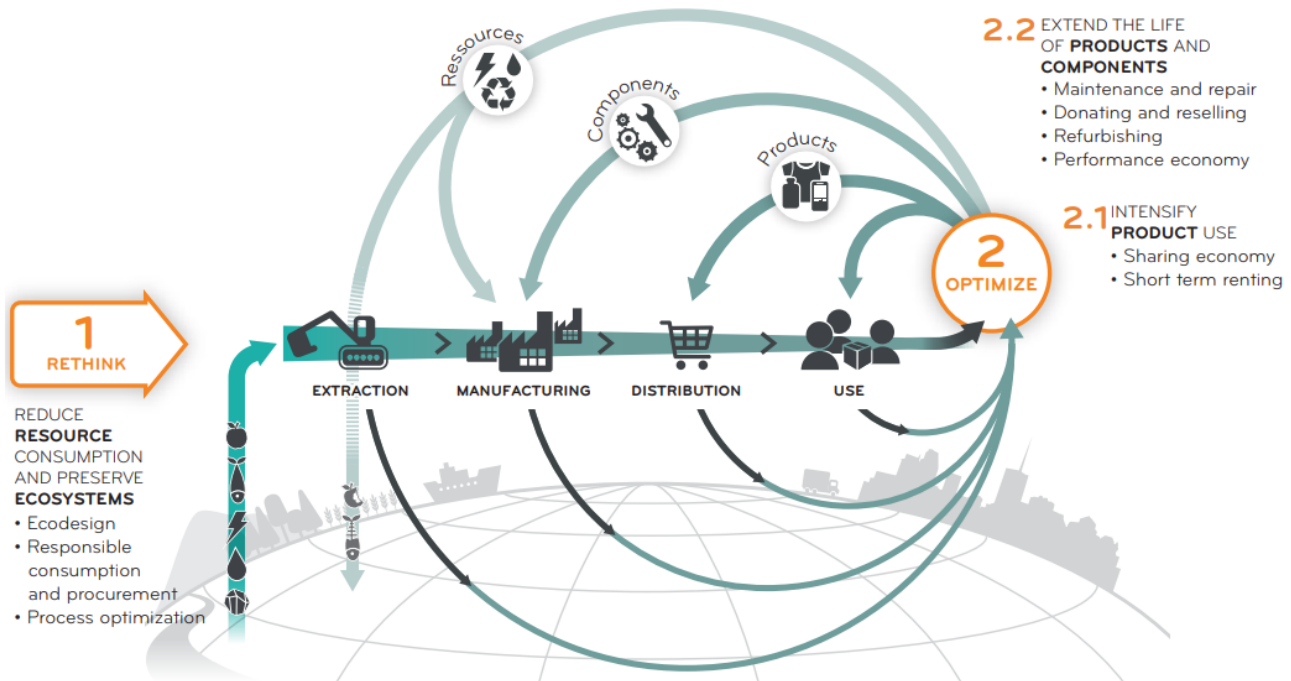
The circular economy is under-pinned by three key principles (as described in the list below, with the first two illustrated in Figure 1), with the entire system being powered by renewable energy.

1. **RETHINK** – Reducing resource consumption and designing out waste, harmful chemicals, and pollution from products and services.
2. **OPTIMIZE** – Keeping products and components at their highest value and in use for as long as possible while minimizing material losses (including design for durability, reuse, and reparability).
3. **REGENERATE** – Preserving ecosystems and regenerating natural capital.

It is important to note that the circular economy does not aim to end growth, but rather to bend economic activities back into harmony with nature so that growth can continue without environmental degradation – it looks to bring prosperity in a world of finite resources.



# CIRCULAR ECONOMY



Source: Institut EDDEC in collaboration with RECYC-QUEBEC.

**Figure 1:** Diagram of the circular economy.

The circular economy sees material flows as being part of two distinct cycles: biocycles and techno-cycles. With respect to the biocycle (i.e., biological loops), the objective is to make biomass return into the biosphere after use – food and wood products from construction as two examples. With respect to the techno-cycle, which is built up of inorganic products and materials such as metals and minerals, the strategy is to keep them in closed loops to ensure the possibility of reuse and recycling and to prevent potential pollution.

## **Circular Economy Equals a Trillion-dollar Economic Opportunity**

The economic opportunities are significant. Accenture has estimated that transitioning to a circular economy could generate USD 25 trillion worth of additional economic output globally by 2050, as well as enhance the resiliency of the global economy and its supply chains.<sup>9</sup> As stated by the World Economic Forum: *“Circular business models will gain an ever greater competitive edge in the years to come because they create more value from each unit of resource than the traditional linear ‘take-make-dispose’ model.”*<sup>10</sup>

Leveraging the biological loops present opportunities within the bioeconomy – an underpinning component of the broader circular economy model. Representing 7% of today's economy, the circular bioeconomy looks to capture maximum value from biological resources. The sustainable supply of feedstock, coupled with forest and soil carbon cycling and storage capabilities, carbon storage in bioproducts, and the composting / re-integration of biomaterials into the biosphere creates enormous

value. As a result, the circular bioeconomy is estimated to present a USD 7.7 trillion opportunity in 2030 related to new products, energy, and capturing value from agriculture and forestry waste.<sup>11</sup>

**Alignment with Sustainability Goals and Climate Action**

While the term ‘circular economy’ is relatively new, the underlying concepts have been around for decades and are based on principles linked to sustainable development, industrial ecology, ecological economics, design-for-environment, cradle-to-cradle thinking, biomimicry, and others.<sup>12</sup> It was, in fact, an American economist Kenneth Boulding in his 1966 article, “the economics of the coming spaceship earth”, that highlighted that humans live on a planet with finite natural resources and, because of that, a linear economy will not succeed over the long-term.

Given its underlying principles, the circular economy has strong alignment with the United Nations’ Sustainable Development Goals (SDGs) as it relates to broad environmental and social sustainability considerations, as well as the Paris Climate Agreement for its potential to reduce global greenhouse gas (GHG) emissions.

The circular economy contributes to preserving ecosystems and biodiversity given reduced demand for raw materials lowers the need for land use change. It also seeks to remove harmful chemicals from production processes reducing the risk of environmental pollution.<sup>13</sup> The circular economy model can also help to tackle some of the 45% of GHG emissions that are attributable to land use changes and non-energy industrial activities.<sup>14</sup> It is estimated that two-thirds of GHG emissions are released during the extraction, processing, and manufacturing of goods<sup>15</sup> – applying circular economy strategies in just five key areas (cement, aluminum, steel, plastics, and food) could reduce global emissions by 40% in 2050.<sup>16</sup>

**Recognizing the Benefits of the Circular Economy**

As the circular economy model evolves, the benefits to governments, to companies, and to communities at large are becoming better understood. Some of the identified benefits are outlined in Table 1.

Many Indigenous peoples are also alive to the circular economy model and understand its potential benefits given its alignment with traditional ways of living in harmony with the natural environment and within ecological boundaries, while simultaneously presenting new economic opportunities.

**Table 1:** Potential benefits from the circular economy to various key stakeholders.

<b>Benefits to Governments &amp; Society</b>	<b>Benefits to Companies</b>	<b>Benefits to Communities</b>
<ul style="list-style-type: none"> <li>• Reduce GHG emissions and mitigate climate change</li> <li>• Maximize the value from resources and materials and increase resource security</li> <li>• Restore and regenerate natural capital and ecosystems</li> <li>• Create resilient jobs and attract investment</li> <li>• Relieve pressures on municipal services and budgets</li> <li>• Opportunity to leverage innovation and demonstrate technology leadership</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce resource and carbon-intensive energy consumption</li> <li>• Reduce operating cost</li> <li>• Improve competitiveness</li> <li>• Strengthen relationships and brand (customers, employees, suppliers)</li> <li>• Diversify revenues</li> <li>• Mitigate risk (e.g., supply chain resiliency)</li> </ul>	<ul style="list-style-type: none"> <li>• Increase disposable income</li> <li>• Encourage an innovation-rich local economy</li> <li>• Reduce GHG emissions and pollution</li> <li>• Improve quality of life and livelihoods</li> <li>• Create diverse employment opportunities</li> <li>• Alleviate social inequalities</li> </ul>

It is important to recognize, however, that the benefits from the circular economy may not be uniformly distributed across sectors, geographies, populations, and/or communities (e.g., urban and rural). That being said, prioritizing an inclusive circular economy can both support diversity and resiliency over the long-term, which will be essential to accelerating the transition.

### *About this Discussion Paper*

While it is fair to say that transitioning to a more circular economy presents a tremendous global opportunity, what does it mean for North America more specifically? Success hinges on defining the region's unique capabilities, addressing key challenges and barriers, and unlocking the innovation that will drive new business models and systems-thinking in support of a circular transition.

Defining the opportunities for North America will require an understanding of where things are today, what the end goal is, and how to get there – identifying relevant natural resource industry strengths while leveraging service-based sectors and the broader innovation ecosystem.

The circular economy involves collaboration and systems-thinking at three scales that are important within the North American context:

- **Macro-level** – At the industry / supply chain or jurisdictional (e.g., cities, provinces, regions) levels;
- **Meso-level** – At the community or corporate levels; and
- **Micro-level** – At the product or individual consumer levels<sup>17</sup>

This Discussion Paper focuses on the macro-level where broad systems change can occur. At the jurisdictional level, for example, changes may occur to the built environment, within energy and mobility systems, and production systems that can leverage the bioeconomy and enhance 'local value loops'<sup>18</sup>

A future vision for what a circular North America could mean – in terms of the benefits to businesses, communities, and society at large – is put forward in the next section, followed by an overview of the current situation in North America and considerations for future actions required to realize the vision and the full potential of the circular economy.

### 3. Vision for a Circular North America

Building a circular economy in North America will require an enormous structural and cultural shift to address the currently unsustainable linear model – on the scale of the industrial revolution. While daunting, the challenge can also inspire. If we envision the future we want, we can better understand the opportunities and pathways for getting there.

Let's put the challenges aside for a moment and imagine what a truly circular economy in North America could look like – one that reimagines how we make our goods and deliver our services, how we feed, heat, and cool ourselves, how we live and work, how we get around, and what we do with products at end of use. To be clear, it is not about an economy that is insular or closed off from the rest of world, but rather one that looks to strengthen supply chains, extracting the maximum value of goods and resources while regenerating nature and improving the quality of life for all. If we get it right, North America could become a region with minimal waste (like in nature), where materials and resources are preserved and valued at their highest potential. It is a world that is powered by renewable energy and low-carbon solutions.

#### *Healthy and Sustainable Communities Prosper*

We will see a future in which our cities and communities are healthier given less pollution and harmful chemicals in the environment, and more resilient given secure access to essential goods and services. Cities and communities are incubators for new ideas and creative business models. Our homes, buildings, and infrastructure are 'material banks', designed to be deconstructed and repurposed at their end of life from the use of renewable and recycled materials, including wood and low-carbon concrete in their construction. Investments in natural ecosystems result in more green spaces and restored biodiversity.

#### *Engaged Citizens and Businesses Collaborate and Inspire Innovation*

The barriers and structural challenges to circularity will have been addressed. Collaboration across governments, business sectors, academic and applied researchers, non-governmental organizations, and Indigenous communities has resulted in a thriving innovation ecosystem that leverages our strong foundation in areas such as industrial ecology and systems thinking, while incorporating nature-based solutions and Indigenous generational knowledge and practices.

Awareness of the circular economy is widespread among citizens, with education starting at the primary level so as to empower youth. Citizens now recognize the value of and demand for high-quality products that last longer and can be shared, rented, reused, and easily repaired – including everyday items such as vehicles, electronics, small appliances, clothing, and furniture. People know that if something is broken, it makes sense and costs less to fix it rather than to throw it away and buy new. Repair centres and clinics allow for youth and craftspeople alike to come together, creating jobs in the process. The fewer items we do buy from stores are often refurbished or remanufactured, come with less packaging, and are fully recyclable – and no plastics or harmful single-use items end up in our oceans or waterways.

Innovative and creative design thinking has reduced the environmental impacts from our products and packaging, using nature-inspired concepts like biomimicry to bring forward solutions and eliminate harmful substances, chemicals, and toxins from our goods, materials, and processes. Technology firms across North America are working with partners to tackle local and global challenges through creative circular solutions that have positive impacts which reverberate around the world.

Investments in circular companies, communities, and infrastructure are creating new jobs and opportunities that pay living wages. Investments in workforce training and upskilling ensure that no one gets left behind – providing valuable and transferrable skills that are adapted for more resilient business models. The transition results in an improved quality of life for citizens, enabling economic mobility and addressing social inequalities.

### ***Industry Leads the Transformation***

North America's natural resource strengths continue to play a vital role in our economy. Well-managed forests and agricultural lands are resulting in productive and resilient industries that apply circular thinking to provide ecological services and sequester carbon and nutrients, while producing the materials and feedstock needed for a range of high-value bio-products such as energy, pharmaceuticals, biochemicals, and light but strong biomaterials. Food loss and waste has been considerably reduced through precision agriculture technologies and practices (reducing environmental impacts and land use pressures), more efficient and innovative supply chains and manufacturing, and significant changes in behaviour at the consumption end.

Primary resource and manufacturing sectors have enhanced their production technologies and processes to allow for the reintegration of secondary, recycled, and recovered materials, improving access to resources across North America and the resiliency of global supply chains. Companies understand the value of what comes out of their factories and are appropriately incentivized to find alternative uses for their resources at end of life other than the landfill.

Manufacturing facilities are saving money by using minimal amounts of energy and water during production, using fewer virgin material inputs, and producing next to zero waste through the application of innovative clean technologies. What does come out at the end of the process are considered resources that are sold to nearby companies and other industries, creating new revenue streams and saving on costs such as water treatment and landfill fees. At the same time, a high-quality, predictable flow of secondary, recycled, and recovered materials are reintroduced upstream into the manufacturing process. The entire industrial ecosystem is enabled through circular product design, efficient supply chains and infrastructure that allows for a blending of primary and secondary materials across borders to repair, disassembly, and remanufacturing hubs using low-carbon transportation solutions – with a focus on local supply chain inter-connections.

### ***Policy Drives Action***

All of the above is inspired by the diversity of our peoples and through a collective strategy for North America that drives innovation, attracts investment, and creates jobs. Collaboration across all levels of government has allowed for policies and regulations to be harmonized and barriers removed, including issues related to circular economy trade across borders. Better metrics, increased data collection and analytics, and information sharing underpin our ability to measure prosperity (e.g., moving beyond gross domestic product as the primary metric for prosperity) and track our circularity transition, ensuring we are moving in a positive direction for all.

## 4. Circular North America: Where are we today?

The vision presented in the last section is hopeful and meant to inspire – but realizing this future will take work. Data suggests that the global economy is less than 10% circular.<sup>19</sup> The reality for North America, however, is that a full understanding of baseline circularity and other key metrics or performance indicators are lacking, creating challenges in terms of measuring progress.

We know that Canada and the U.S. currently generate some of the highest average amounts of waste per capita in the world, at approximately 2.21 kilograms per day.<sup>20</sup> Comparatively, Mexico produces approximately 1.16 kilograms per person daily.<sup>21</sup>

It is estimated that the United States discards nearly 500 billion pounds of solid waste per year, three-quarters of which could be recycled or repurposed (although only 30% currently is).<sup>22</sup> In Mexico, it is estimated that only 47% of the full potential economic value from recycling is captured.<sup>23</sup>

The global COVID-19 pandemic has also created a waste crisis in the immediate term, including the use of more disposable items (such as plastic bags, take-out containers, and disposable menus) and personal protective equipment (such as masks, face shields, and gloves). The significant drop in oil prices has also challenged the business model for recycled plastics when compared with cheaper virgin materials.

### *Insights from Other Regions*

Analysis on the ‘circularity gap’ from other national-level jurisdictions can provide some insight. Norway, for example, a resource rich, trade-dependent country with high consumption habits similar in some respects to Canada, was found to be only 2.4% circular.<sup>24</sup> Mexico is in the process of undertaking a circularity gap assessment, as are the Province of Quebec and the City of Toronto (to be published soon).

There are various drivers and factors that influence the circular economy transition – and these vary by region. Over the last two decades, the circular economy dialogue has been maturing in Europe, as well as in a handful of other countries, particularly in Asia (including China and Japan).

In Europe, for example, circular economy conversations have become more prominent, encouraging new business models that seek to reform and even eliminate the concept of waste altogether. In 2015, a comprehensive and overarching European Union (EU) policy initiative was developed – referred to as its “Circular Economy Package” and corresponding Action Plan – which aimed at improving competitiveness by protecting EU businesses against the scarcity of resources and volatile prices, helping to create new business opportunities and innovative, more efficient ways of producing and consuming. In fact, analysis suggests that the circular economy could save European businesses up to USD 630 billion per year.<sup>25</sup> A new Circular Economy Action Plan was adopted in March 2020 as part of the European Green Deal.<sup>26</sup>

Policies in China have more heavily focused on upstream components and the manufacturing supply chain to ensure access to critical materials, resources, and feedstocks while, in Japan, key drivers have included a lack of land for waste disposal, as well as a shortage of raw materials that could be sourced domestically, producing incentives for greater levels of recycling and waste diversion.

## ***North America's Unique Strengths and Characteristics***

It is fair to say that North America is starting from a different position and with a different set of strengths – however, it is not starting from scratch. While circular economy discussions in North America are still largely focused on waste management and recycling initiatives at present, the region's unique strengths and characteristics can form the foundation for a more holistic circular economy transition. The following factors are considered in more detail in the sub-sections below as they relate to the current North American context:

- Industrial base and natural resource strengths
- Population density and geography
- Culture and mindset
- Underlying infrastructure
- Innovation ecosystem and corporate leadership
- Policy, governance, and jurisdictional control

## **4.1 Industrial Base and Natural Resource Strengths**

### ***North America's Industrial Base as a Foundation***

The fabric of North America's industrial base is fundamental to realizing the circular economy opportunity. The industrial base varies by country, as well as geographically by region. Many multi-national corporations are based out of North America, including major consumer brands and the manufacturers of household goods, electronics, and fashion.

The United States is a world economic powerhouse with the largest nominal gross domestic product (GDP) in the world, valued at USD 18.46 trillion, which translates to 22% of the world's GDP. The economy of the United States can be divided into three broad categories:

- The service sector (including real estate, finance and insurance, health and social care, education, retail, and public sector);
- The manufacturing sector (including technology and durable consumer goods such as information technology, automotive, and aerospace); and
- The natural resources sector.

Canada ranks 10<sup>th</sup> globally in terms of GDP. The service industry is a significant driver of the country's economy, although compared with other developed nations, primary resource sectors (forestry, agriculture, fishing, mining, and energy) continue to play important roles in specific regions of the country – representing approximately 11% of GDP in 2019. The manufacturing industry is also highly developed in certain areas of the country, ranking as a global leader in raw materials and intermediate (semi-finished) goods and products in sectors such as aerospace, automobiles, and software development.

A study assessing Canada's circular economy potential found the total GDP of industries assumed to have the capability to integrate secondary materials into refurbished or remanufactured products in Canada was CAD 277 billion, representing 14.7% of national GDP in 2016.<sup>27</sup> The relevant industries from this study with the highest GDP were found to be construction (52%) and manufacturing (34%). At the industry level, the economic importance of the construction sector is followed by primary and fabricated metal manufacturing (9.5%), food manufacturing (9%), and mining and quarrying (8%).<sup>28</sup>

Mexico has the world's 15<sup>th</sup> largest GDP, with the second largest economy of all Latin American countries. Petroleum products, mining, and manufacturing are some of Mexico's biggest industries, making up approximately 35% of GDP. Mexico's manufacturing sector is dominated by industries that include automotive, aerospace, medical devices, and electronics – as well as manufacturing plants that take in imported raw materials and produce goods for domestic consumption and export on behalf of foreign companies (commonly known as maquiladoras), a segment that has historically benefited from the North American free-trade agreements.

Design and product specifications for many of these goods take place outside of Mexico in the headquarters of multi-national companies that prescribe to Mexican manufacturers how to produce, manufacture, and assemble according to their product specifications. Mexico, as such, lacks decision-making power on when these companies decide to change the design of their products and production processes to fit circular economy pattern.

### ***Natural Resources are a Circular Economy Strength***

North America has historically been known as a resource rich economy. Canada is estimated to have the 3<sup>rd</sup> highest total value of natural resources in the world at USD 33 trillion, while the U.S. comes in at 7<sup>th</sup> highest.<sup>29</sup> This reality creates somewhat of a unique opportunity where scarcity of resources is less likely to be the primary driver for the circular economy. Instead, innovation in areas such as the circular bioeconomy (i.e., enhanced use of forestry and agricultural feedstock, both domestically and for export) and mineral and metal recycling and secondary manufacturing are presenting large growth opportunities.

North America has a base to build on in these areas already. As an example, the forestry sector is involved in value-add engineered wood products for the building of modular housing and tall-wood buildings. Wood fibre and agricultural waste materials are being transformed into useful products such as compostable bioplastics, biofoam insulation, and even compostable personal protective equipment such as face masks in light of the current COVID-19 pandemic.

***The scarcity of resources is less likely to be the primary driver for the circular economy in North America. Instead, innovation in areas such as the bioeconomy, mineral and metal recycling, and secondary manufacturing and remanufacturing may present some of the largest growth opportunities.***

The *Canadian Minerals and Metals Plan* has identified the circular economy, including metals recycling and reprocessing, as a key area for action.<sup>30</sup> The Canadian Mining Innovation Council has launched its "Towards Zero Waste Mining" that has identified opportunities to transform mining processes, advance energy efficiency, and reduce GHG emissions through recovering heat loss in mineral processing; developing and deploying new technologies to minimize waste and improve water quality; and improving ore reserve definition.

Further work is underway in Canada to assess the economic opportunities through a multi-disciplinary Expert Panel on the Circular Economy led by the Council of Canadian Academies.<sup>31</sup>



## 4.2 Population Density and Geography

North America is known by many as a “land of plenty” – a continent with a large geographic expanse, that is rich in resources, and has a low population density (see Table 2).

**Table 2:** Continents by population density.

Rank	Continent	Population Density (Km Squared)	Population Density (Mi Squared)
1	Asia	95.03	246.11
2	Europe	72.51	187.84
3	Africa	33.66	87.15
4	North America	22.13	57.29
5	South America	22.00	56.90
6	Australia	3.12	8.37

Source: World Atlas.<sup>32</sup>

While the relatively low population density and access to nature are some of the region’s greatest attributes, they have also contributed to urban sprawl. This also create unique challenges in terms of the cost of doing business and the investments needed to support the required infrastructure and service delivery models of the circular economy, unlike in Europe and Asia.

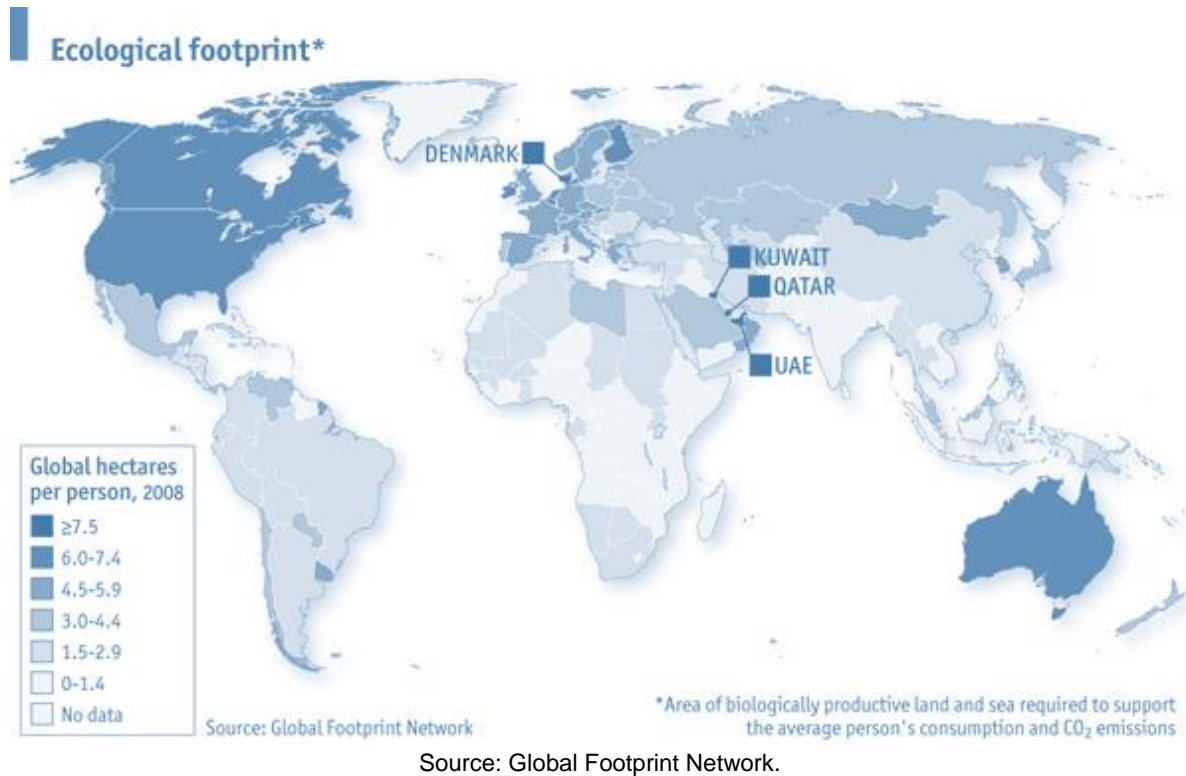
As a result, the cost to set up recycling collection or the potential to achieve economies of scale related to reclaimed materials and resources across supply chains that are geographically widely distributed creates challenges. In addition, landfilling costs remain relatively low, with the impacts largely ‘out-of-sight and out-of-mind’, thereby reducing or eliminating an incentive for change.

*North America’s relatively low population density has created unique challenges in terms of the cost of doing business and the investments needed to support the required infrastructure and service delivery models of the circular economy.*

While the geographical distribution does pose challenges, the market has adapted by creating north-south recycling regions, especially between Canada and the U.S. and the U.S. and Mexico. With the trend toward urbanization, new opportunities will arise for North American cities and communities that could have an impact on product demand, such as more service-based business models like ride sharing and product reuse and repair.

## 4.3 Consumption, Culture, and Mindsets

The prevailing societal mindset of ‘plenty’, based on access to a wealth of natural resources and abundant land and space, has created some apathy (or lack of necessity / urgency) with respect to the circular economy in many parts of North America. A culture built around consumption (tied to wellbeing) has resulted in the United States and Canada ranking in the top countries globally with the largest ecological footprint per capita (see Figure 2). The nature of the primary resource and extraction industries and the large geographic distances contribute to this footprint. Mexico, in contrast, is a complex country with two rather different and often contradicting faces: a modern and a premodern one. These two together influence Mexico’s pace of transforming toward a circular economy.<sup>33</sup>



**Figure 2:** Ecological footprint by country (global hectares per person, 2008).

### ***Cultural Diversity Brings Innovation***

While culture and mindset can, at times, divide people or result in apathy, it can also be a strength and a motivator for collaboration. Recent movements pushing for social reform and environmental justice are examples. North America's diverse cultures and economies bring with them a mindset where innovation can flourish, supported by an openness to idea flow, technology adoption, information sharing, and communication.

Indigenous peoples in North America also bring an enormous cultural strength that could inspire a focus on stewardship of the land and resources, with wisdom and practice that can be brought to bear in support of the circular transition and systems change that is needed. This can also link with work that is underway to reclaim economics using an Indigenous worldview within the modern economic space. As such, North America has a strong foundation for accelerating the circular economy by building on its diverse cultures should an inclusive approach be adopted.

## 4.4 Underlying Infrastructure

North America sees an inconsistent and often insufficient level of infrastructure required to support the circular economy, which also varies by country and by state / province / territory.

### *Circular Economy-related Infrastructure Varies Across the Region*

Infrastructure for the collection and management of waste materials and recycling is a patchwork that often involves a hybrid of private sector and public sector oversight. In some jurisdictions, such as California, British Columbia, Quebec, and Ontario, recycling systems are well-established and, increasingly, funded by industry through extended producer responsibility (EPR) programs. The Metro Vancouver region (in British Columbia), for example, has achieved a diversion rate of 64%. Phoenix, Arizona, went from a 20% diversion rate in 2015 to achieving 36% diversion as of 2019 due in part to targeted investments in infrastructure and related programs.

In other locations, particularly in Mexico and some parts of the United States, as well as more rural and remote locations across the continent, waste management and recycling infrastructure may be lacking altogether. In the Northern parts of Canada, for example, territories struggle with providing recycling programs due to the cost of expanding the infrastructure and maintaining collection services.<sup>34</sup> In Mexico, while the country has approximately 650 open-air dumpsites and about 200 landfills, many of them are in poor condition and lacking basic infrastructure to ensure a sound operation and monitoring of the waste streams. A lack of infrastructure to support diversion and recycling is also a key challenge in Mexico.

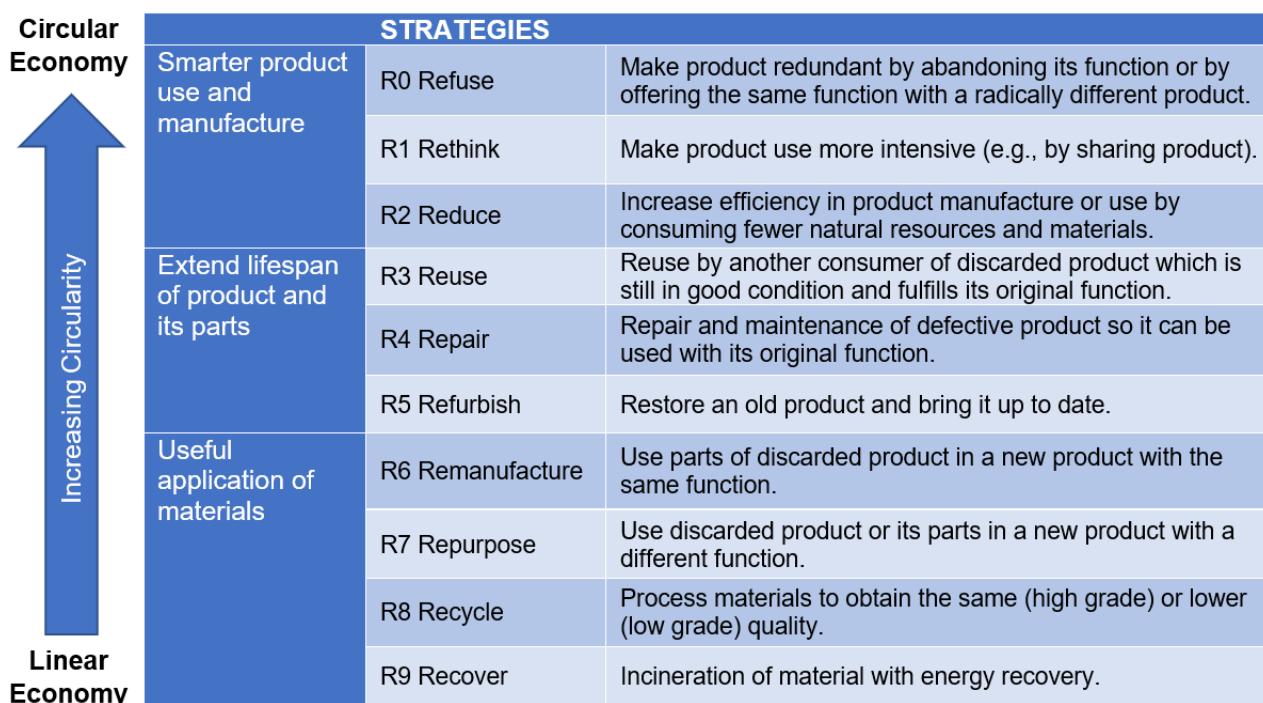
*Existing infrastructure gaps can allow jurisdictions to “leapfrog” the traditional waste management system and focus more on the upstream components of material flows in areas such as material use reduction, product redesign, reuse, remanufacturing, and repair.*

In some regions, value-added manufacturing exists while, in others, raw materials are extracted and sold at their lowest value to the global marketplace. At the moment, remanufacturing makes up only 2% of production in the United States.<sup>35</sup> At the same time, the revitalization of former industrial heartlands, in areas such as the Great Lakes Region, could support the remanufacturing sector and repurpose under-utilized infrastructure and assets for circular product innovation (such as Detroit’s automotive manufacturing hub), creating new employment opportunities (see **case study on the REMADE Institute** in the Appendix). This includes the development of secondary material marketplaces.

### *Infrastructure Gaps Present Opportunities to “Leapfrog”*

In Europe, many Nordic countries (such as Sweden and Denmark) have invested in waste-to-energy facilities to heat and power their communities and now struggle to move away from this infrastructure given investments that have been made and the entrenched business and revenue models that, in some cases, now involve importing waste from other countries in order to fuel the systems.

In North America, the choice can be made to avoid this pathway and invest instead in infrastructure that supports the circular economy to ensure the highest value for materials and resources is captured (in line with the ‘9R’ hierarchy shown in Figure 3). Infrastructure gaps, in essence, may provide an opportunity for some jurisdictions to “leapfrog” the traditional waste management system and focus more on the upstream components of material flows in areas such reuse, repair, remanufacturing, refurbishment, and high-quality or enhanced recycling.



Source: Ellen MacArthur Foundation (adapted from Circular Economy: Measuring innovation in product chains).  
[https://www.ellenmacarthurfoundation.org/assets/galleries/CEinaction-Activity06-nine-Rs-6R3\\_from-graham-081217.pdf](https://www.ellenmacarthurfoundation.org/assets/galleries/CEinaction-Activity06-nine-Rs-6R3_from-graham-081217.pdf)

**Figure 3:** 9R waste-resource management hierarchy

## 4.5 Innovation Ecosystem and Corporate Leadership

The innovation ecosystem in North America is well-advanced, with access to funding and financing designed to take ideas from concept to scale. Universities and applied research are world leading in areas that include synthetic biology, material innovation, artificial intelligence, digital platforms, and more. While clean technology ('cleantech'), including renewable energy and energy efficiency has received a fair amount of attention in the last decade, less attention has focused on circular economy related innovation and solutions in North America (e.g., technology or business model innovation) in areas such as design for repair and disassembly, robotics for sorting recycling, and remanufacturing.

### *Corporate Leadership is Driving Impact*

Corporate leaders are mobilizing around key issues, including regenerative agriculture and plastics pollution (see **case study on the U.S. and Canada Plastics Pacts** in the Appendix). In September 2020, Walmart, the world's largest retailer (headquartered in the U.S.) established a goal to become a regenerative company, looking to reach zero emissions across all of its operations by 2040 and aiming to protect, manage, or restore at least 50 million acres of land and one million square miles of ocean by 2030.<sup>36</sup>

North America also houses some of the world's largest and most innovative technology companies that can help resolve some of the major obstacles to uptake of circular business models through digitization. Many of these companies have circular economy ambitions, targets, and activities underway. Google,

Amazon, and Cisco, for example, are all members of the Ellen MacArthur Foundation's global circular economy network. In 2017, Apple announced that it would make its products with 100% recycled or renewable materials (although no target date for this has yet been set).<sup>37</sup>

In addition, there are many small-scale disruptors and innovators actively advancing technologies and new business models in areas that include resource recovery, circular supply chains, product life extension, and product-as-a-service and sharing platforms.

## 4.6 Policy, Governance, and Jurisdictional Authority

The political and governance structures, as well as jurisdictional controls across North America, are varied and complex. The regulatory environment is relatively well-developed; this regulatory framework can form a foundation for furthering the circular economy – although opportunities exist to further develop and enforce regulations that recognize ecological boundaries and science-based principles.

### *Policy Leadership on Circular Economy is Growing*

Federally, Canada has been showcasing leadership on climate action and circular economy, including:

- Its 2030 GHG emission reduction targets and a plan to legislate Canada's goal of net-zero emissions by 2050; and
- The Ocean Plastics Charter, the Canada-wide Action Plan on Zero Waste Plastics (in collaboration with the Canadian Council of Ministers of the Environment), and related single-use plastic item regulation that is under development.

In Mexico, the *Sector Program for the Environment and Natural Resources* aims at strengthening the country's low-carbon economy, recognizing the need to improve existing infrastructure for reuse and recycling and for supporting states, regions, and municipalities with their waste management plans. At the same time, implementation and enforcement of regulation creates challenges, as does corruption in some instances.

In the U.S. and Canada, state and provincial / territorial governments hold a fair amount of policy, legislative, and regulatory power, in combination with the federal governments. This is somewhat different from the European model where capital cities combined with national governments tend to drive policy. For example, the City of Copenhagen and the Danish government work in close collaboration to shape legislation and policy action. Most European countries are also members of the European Union, which provides a top-down framework for policy, the European Commission's Circular Economy Package as one example.

Several states in the U.S. are writing supportive legislation that recognize circular economy principles, such as New York, California, and Oregon. However, it is cities that are really coming to the forefront with circularity strategies, policies, and regulations within their control. Cities such as New York, San Francisco, Austin, Phoenix, Charlotte, Toronto, Montreal, and Vancouver are a few examples (see **case studies on leading cities** in the Appendix).

### *Effective Policy Requires Harmonization*

Fragmentation within the policy and regulatory environment creates challenges for cross-jurisdictional waste management, as well as the flow of goods, materials, and resources, creating a need for better harmonization. The patchwork across jurisdictions also presents opportunities for jointly developing policy and clear regulation to support the circular economy transition across the continent.

The Commission for Environmental Cooperation (CEC) is helping to harmonize policy efforts between Canada, the U.S., and Mexico, including a focus on circular economy and materials management that is highlighted in its new 2021-2025 Strategic Plan.<sup>38</sup> In addition, ongoing efforts in the Great Lakes and Saint Lawrence region through the U.S. Chamber of Commerce Foundation and the Council for the Great Lakes Region present excellent models of cross-border collaboration (see **case study on the Great Lakes Region collaboration** in the Appendix)<sup>39</sup>.

### ***Indigenous Policy & Governance Issues***

Policy and jurisdictional challenges and opportunities can also vary by region and by community. For example, many Indigenous communities in Canada struggle under existing policy and governance structures, such as the Indian Act, which is a Canadian federal law that governs in matters pertaining to Indigenous people's status and reserve lands, regulating and limiting the decision-making of Indigenous peoples regarding their reserve lands and traditional territories at the broader regional level. As such, governance, policy, and legal reform is needed in order to incentivize and allow for business innovation and entrepreneurship, as well as for removing barriers to investment and private sector collaboration in line with the circular economy transition within Indigenous communities.

The following section explores in more detail the key barriers that must be addressed and drivers that can support the transition to a circular economy in North America.

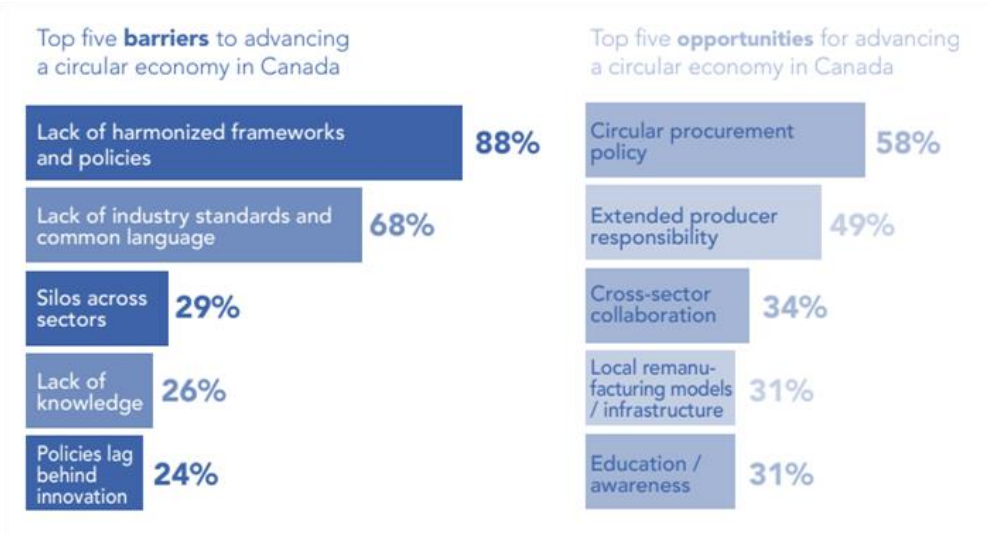
# 5. Realizing the Vision: Addressing barriers and seizing the opportunities

Accelerating a circular economy in North America will require numerous changes in business models, practices, and policies. Circular economy strategies have the potential to deliver deep business value – which in turn incentivizes industry and the private sector to lead, and presents new opportunities for economic renewal, investment attraction, diversification, and job creation. However, changing an established, strong, interconnected system will take time, multi-stakeholder collaboration, and coordination to tackle barriers and leverage the enablers that will drive the demand for and supply of circular economy products and solutions.

### Barriers

A key barrier is the fact that, in many cases, it remains cheaper to continue with the linear economy status quo – in large part due to a failure for recognizing existing economic and environmental externalities currently borne by society (e.g., the cost of pollution, health care impacts, etc.). Some of the additional top barriers and opportunities for advancing the circular economy are shown in Figure 4, identified as part of a workshop on advancing the circular economy in Canada in February 2020 with more than 100 sector experts and stakeholders.

The challenges highlighted below support findings from studies that have been published in Canada, the U.S., and Mexico that speak to the need for more policy support and harmonization; investments in technology, infrastructure, and innovation; and greater collaboration and information sharing.<sup>40</sup>

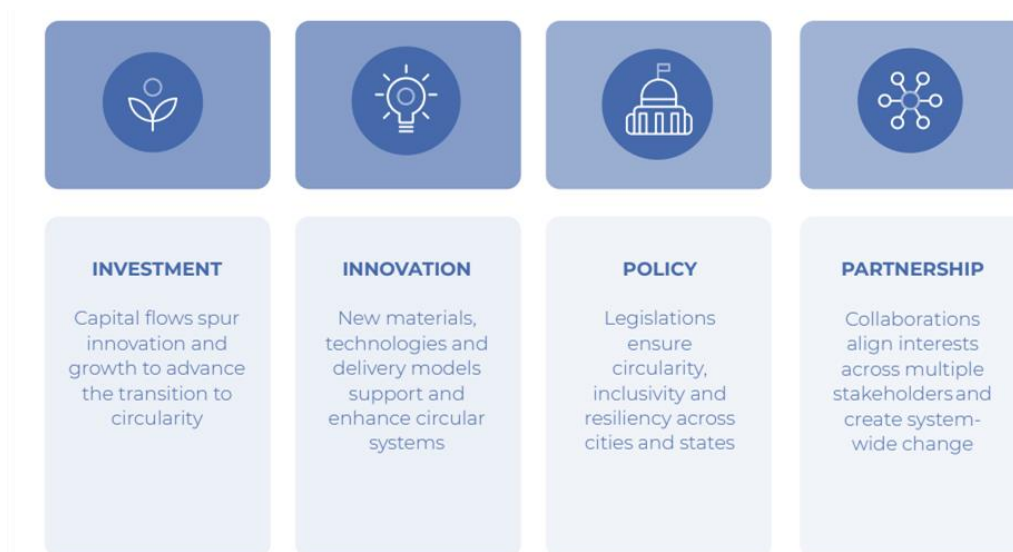


Source: GLOBE 2020 Advance Workshop on Advancing a Circular Economy in Canada<sup>41</sup>

**Figure 4:** Top barriers and opportunities for advancing the circular economy in Canada.

### Four Key Drivers

Closed Loop Partners highlights four important drivers for the circular economy in North America, which are: partnerships, policy, innovation, and investment (as illustrated in Figure 5). A focus on these four drivers can support an accelerated transition for North America, enabling opportunities and helping to achieve the vision. Each of these drivers is explored in more detail below.



Source: Closed Loop Partners<sup>42</sup>

**Figure 5:** Four key drivers for the circular economy in North America.

## 5.1 Partnership

### *Cross-sector, Cross-jurisdictional Collaboration*

Given the systems-based thinking required to be most effective, circular economy leaders are adopting an integrated approach that involves multi-stakeholder, multi-government and cross-sectoral partnerships and cooperation.

Countries in North America have a long history of strong, transboundary cooperation. Dealing with trade-related aspects of resource-intensive sectors will be particularly pertinent to how the circular economy evolves in North America. Collaboration across industries and supply chains present new opportunities, particularly as it relates to cross-border trade (domestic and international), including leveraging North America's underlying natural resource strengths and the industrial base. Opportunities include:

- Expanded supply chains for renewable feedstock and a wider range of high-value, bio-based materials;
- Advancing industrial symbiosis and waste-to-resource connections for secondary material streams, including remanufacturing hubs, eco-industrial parks, and supporting material marketplaces similar to efforts going on in the Great Lakes Region and elsewhere;
- Technology, policy, and knowledge sharing partnerships between cities and states / provinces / territories, and in line with existing initiatives such as the Cascadia Innovation Corridor, that involves West coast states in the U.S. and British Columbia.

The circular economy transition will likely introduce structural changes to the economy and have impacts on trade flows. Import and export demand for primary materials, secondary materials, and waste may increase or decrease and may also bring new opportunities for trade in services.<sup>43</sup>

It will be important to address current trade barriers as they relate to the circular economy transition posed by current trade laws and structures. At present, the movement of materials and waste (resources) across North America and at the broader global level creates significant challenges with



respect to their tracking and management, especially those containing chemicals of concern, and underscores the need for collaboration and harmonization, as well as support for the infrastructure that enables reverse logistics. Other trade related issues include: the classification of reclaimed / recycled materials, transactional costs, permitting processes, and restrictions within existing trade policies and multilateral environmental agreements (such as the Basel Convention and Canada-United States-Mexico Agreement).<sup>44</sup>

### **Education and Workforce Development**

Opportunities to embed circular systems thinking into curriculum and skills training from primary school levels through to higher education in line with the 9R framework exist across the region. For example, programs such as courses in industrial ecology offered in the United States and, most recently in Canada, provide the foundation for circular innovation, as do courses through various institutions in areas such as systems-thinking, material flow analysis, life cycle assessment, reverse logistics, and biomimicry design. Post-secondary institutions can develop best in class programs and leverage their campuses for experimentation and learning using a ‘living labs’ model.

Indigenous partnerships and collaboration can bring new opportunities and the ability to learn from traditional knowledge and principles that can enhance regional resiliency and sustainability. Applying a ‘just transition’ lens to workforce and skills development can help generate new entrepreneurship opportunities for diverse populations while also putting people to work helping to build a more resilient economy that is less susceptible to commodity, resource, and supply chain disruptions.

### **Better Access to Information, Data, and Metrics**

A lack of access to information and a common set of metrics and indicators can make collaboration a real challenge. Developing and harmonizing standards and approaches to measurement and monitoring across North American jurisdictions is essential, as well as addressing data ‘siloes’ and integration new metrics that measure diversity and ensure an inclusive circular economy for all North Americans. Improved metrics and data collection can also help to better track the movement and flow of materials and resources and understand our circularity gap (see **case study on CircularID** in the Appendix).

Efforts are underway to develop better metrics for measuring circularity at the corporate level, including initiatives by the Ellen MacArthur Foundation, the World Business Council for Sustainable Development (WBCSD), and the Global Reporting Initiative.<sup>45</sup> At a macro-level, an opportunity exists to integrate circularity metrics with established climate and environment, social, and governance (ESG) reporting frameworks and accounting standards, such as the CDP for Cities reporting framework. Language and vocabulary also need alignment, ensuring that circular economy concepts, terminology, and best practice case studies are accessible to all stakeholders and can be used to build bridges that support further cross-border collaboration.

## **5.2 Policy**

There is an important role for governments to play in enabling and accelerating circular economy models – reports by organizations such as the WBCSD and Smart Prosperity Institute have outlined many of these key policy enablers.<sup>46</sup> Leading jurisdictions in North America and globally have been implementing policies to support a government “pull” for the circular economy, including a mix of regulations, robust economic instruments, and circular public procurement with key objectives to drive resource efficiency and encourage a shift toward higher levels of the 9R circular economy resource hierarchy.<sup>47</sup>

## **Regulation**

Regulations applied in regions across North America have historically focused on reducing risks to human health or the environment from harmful substances, reducing pollution, controlling hazardous waste, and expanding coverage for extended producer responsibility (EPR) programs which shift the management and financial burden of products and materials at their end of life back to industry.

While regulations such as EPR are important and must be expanded, and harmonized across sub-national jurisdictions, the policy agenda to date for the circular economy in North America has been largely defined by practices focused on waste management and recycling. While important, the circular economy needs a broader lens, going beyond traditional recycling to focus on the management of resources to regenerate natural systems, eliminate harmful chemicals, and keep materials and products recirculating in the economy at their highest utility and value for as long as possible – including developing and adopting the business models to enable this transition.

Regulations are needed in areas that focus on promoting “circular” product design since a large percentage of a product’s environmental impact is determined at the design stage. These should consider the full lifecycle of products, including the second use phase, take-back systems, design for disassembly, reparability, reusability, and recyclability. It can also include targets for recycled content in products and packaging.

## **Economic Instruments**

Economic policy instruments can help to ‘tilt the playing field’ in favour of non-virgin materials and incentivize circular business models. These can include:

- Taxes and fees for waste disposal (both landfill and incineration), which incentivize both waste prevention and increased waste recovery.
- Differentiated pricing for different materials going to landfill and varying volumes of waste (for instance, higher prices for materials that cost more to manage or have a high recycling potential).
- Product taxes and fees to discourage the use of virgin materials and products such as single-use plastics.
- Tax incentives on secondary and recycled materials to encourage more repair, reuse, refurbishment / remanufacturing, and recycling activities.<sup>48</sup>

## **Procurement and Decision-Making Tools**

Moving from a linear to a more circular economic system will increase system complexity. New decision-making tools will be needed to understand how the systems operate and how to evaluate development.

Procurement is an important policy tool and driver for circular products and solutions which, in turn, can help drive consumer shifts and create demand for circular products and solutions. Public procurement refers to the process by which public authorities, such as government departments, regional and local authorities, or bodies governed by public law, purchase works, goods, or services from companies. In Canada alone, CAD 200 billion is spent annually through public procurement.

Different models exist based on considering circular procurement criteria and eco-design requirements that look to increase the potential for durability, resource efficiency, reuse, recyclability, refurbishment / remanufacturing, and/or the potential to buy recycled.<sup>49</sup> These models can vary, from the product to supplier and system levels (see Figure 6).

<b>1. System level</b>	<b>2. Supplier Level</b>	<b>3. Product</b>
→ Product service system	→ Supplier take-back system	→ Materials in the product can be identified
→ Public Private Partnership	→ Design to disassembly	→ Products can be disassembled after use
→ Cooperation with other organisations on sharing and reuse	→ Reparability of standard products	→ Recyclable materials
→ Rent/lease	→ External reuse/ sale of products	→ Resource efficiency and Total Cost of Ownership
→ Supplier take-back systems including reuse, recycling, refurbishment and remanufacturing	→ Internal reuse of products	→ Recycled materials

Source: European Commission's Public Procurement for a Circular Economy Guide.<sup>50</sup>

**Figure 6:** Circular procurement models.

### **Importance of Harmonized Policy**

Various regional contexts will create different opportunities, as well as challenges, and will not respond equally to the same policies. Policy that allows for government objectives to be met while also enabling companies to work together effectively will be important to accelerating the transition to circularity in North America. In Europe, for example, the Green Deal<sup>51</sup> has countries working with the private sector to test out new approaches using policy 'sandboxes' as experimentation labs to work across sectors and come up with effective policies.

The circular economy should be treated as an economic opportunity and, as such, be integrated into cross-cutting and sectoral policies that drive innovation and investments in key infrastructure. Governments at all levels can also use the circular economy as an essential model and framework for advancing climate action goals, driving GHG emission reductions, and for meeting targets.

However, it is important to align and harmonize policy approaches as much as possible (between countries and at various levels of government) to avoid a patchwork of actions which create challenges and uncertainties for business. Harmonization efforts could include:

1. Regulatory cooperation designed to accelerate the circular economy model in North America;
2. Sectoral cooperation, especially in the five key sectors with the largest impact on GHG emissions (i.e., cement, aluminum, steel, plastics, and food) to ensure conformity of assessment methods and certification;
3. Development and use of common international standards to facilitate trade and mitigate potential impacts on trade flows; and
4. Rules-based trade that respects international obligations.

## 5.3 Innovation

Innovation comes in different forms, including system, process, organizational, product design, business model, supply chain, technological, and social innovation. It can come from government-funded activities, academia, and/or the business / private sector.

### *Research and Development*

While North America has a well-established innovation ecosystem, more targeted research and support for circular innovation is needed to ensure North America remains competitive with other international jurisdictions. The European Commission, for example, has over the last two years invested nearly 1 billion Euros from its Horizon 2020 Work Programme into research and innovation for circular economy projects and initiatives, with a goal to become a global leader in business model innovation.<sup>52</sup>

Opportunities exist to build on the existing research and development (R&D) infrastructure and programming in governments, universities and colleges, and private institutions. Conventional research programs have increasingly been leveraging a 'living labs' model, as well as incentivizing industry investment into research clusters and priority areas (e.g., reducing food loss and waste, circular plastics, the built environment, and mining and metals).

### *Technology Innovation*

Technology as it relates to business innovation for the circular economy is a proven enabler – including in the areas of digital solutions, biological sciences, clean technology, and material innovation. Digital technologies, for example, have been highlighted as having potential to enable a more circular economy; for instance, in helping transition from 'physical' product ownership to product-as-a-service models.<sup>53</sup> Emerging digital and other disruptive technologies, such as artificial intelligence, machine learning, additive manufacturing, and blockchain, can also be applied to solving circularity challenges along the value chain and in areas such as plastics and electronics.<sup>54</sup>

Biological sciences and material innovation can include a focus on biofuels, biopharmaceuticals and biochemicals, textiles, building and construction materials, and nanofibres as examples.

Collaboration across the entire value chain as it relates to technology development (from extraction, to retail, to recovery) is essential. Established incubator and 'challenge' models can be leveraged in order to bring business together with entrepreneurs, technology start-ups, policy makers, academia, and the finance community, building on existing efforts.

As one example, Canada has launched a series of challenges that focus on plastics innovation<sup>55</sup> (see case study on the **Canada Plastics Innovation Challenges** in the Appendix). As another example, the World Economic Forum has developed its Scale360° Circular Innovation Playbook designed to fast-track 4IR technology applications to the circular economy by bringing together public and private sector leaders and innovators to further build on existing dynamic local and regional ecosystems for innovation.<sup>56</sup>

## 5.4 Investment

### *Financing*

There is a need for the finance and investor community to further support the business case for circularity. The United States and Canada have considerable financial industries, including a robust angel and venture capital sector in the United States that supports the early stage innovation required for supporting circular economy related projects and technology investments. While the financial system is well-established in Mexico, the country struggles with a poorly functioning credit market that affects investments in large-scale infrastructural projects.<sup>57</sup>

While ESG investments are gaining attention, a gap in capital and financial tools (such as tax credits, low interest loans, and grants) exists across North America for supporting entrepreneurs and companies with circular business model innovation, product and service development and demonstration, and scale up. There are currently very few federal financial support programs in North America targeted specifically to converting ideas into marketable solutions for the circular economy.

A new report by the UNEP Finance Initiative has outlined a number of potential financial instruments that can support the circular economy transition, including:

- Green bonds and loans;
- Transition bonds;
- Sustainability ESG linked loans; and
- Circular economy investment funds.<sup>58</sup>

In Europe, the investment community has begun to develop specialized funds for the circular economy. The European Investment Bank, for example, has been building on its climate change framework to add circular economy considerations.<sup>59</sup> In the U.S., Blackrock released a USD 950 million circular economy equity fund in 2019.<sup>60</sup>

There is a need to scale more of these types of funds, with the potential to replicate models from the ESG community that have worked well for other sectors and focus areas. In addition, federal government programs and arms-length government agencies, such as the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs in the U.S., Sustainable Development Technology Canada (SDTC), and Export Development Canada, could place a greater focus on supporting investments in this space.

Finally, many Indigenous communities in North America struggle with access to financing and large-scale private sector investment. In Canada, for example, Indigenous communities are challenged to gain access to capital beyond government funding due in part to the inability to mortgage assets on reserve lands given underlying title to indigenous reserve lands is held by the federal government. New models and mechanisms are needed, such as Indigenous investment banks, or alternatives to mortgage based financing, in order to provide access to capital for these communities.

## **Infrastructure**

Investments in infrastructure to support the circular economy are essential. Having the right types of infrastructure, in the right geographic locations, is critical to whether resources and value can be captured at end of life to use again or whether they are lost through the current linear system (see **case study on the PetStar recycling partnership** in the Appendix).

Critical infrastructure required includes:

- **Recycling and organics processing infrastructure** – including collection, sorting, and processing;
- **Remanufacturing infrastructure** – that support reverse supply chain and logistics for the secondary processing and refurbishment of products and materials;
- **Reuse and repair facilities** – including take-back centres and specialist logistics; and
- **Information and communication technologies** – including access to the internet and broadband / wi-fi infrastructure to enable access to ‘digital’ solutions.
- **Green infrastructure and nature-based solutions** – to support low-carbon and regenerative solutions for energy, water, and the supply of other important economic inputs.<sup>61</sup>

While land use and population density are important considerations here, having the required capital investments to support the emerging business and reverse supply chain models for closing loops is essential. Investments in these critical infrastructures provide opportunities for pandemic-related economic recovery spending as part of ‘build back better’ strategies.

*Investments in critical infrastructures provide opportunities for pandemic-related economic recovery spending as part of ‘build back better’ strategies.*

## 6. Conclusions

The circular economy presents a tremendous opportunity for North America to rethink how resources are used and recaptured, products are designed and repaired, and new services are leveraged to support a resilient economy that rebuilds economic and natural capital and provides society-wide benefits.

Moving away from the current linear model and transitioning to a circular economy does not look to close doors to international trade, but rather allows more value to be captured from the region's natural resources and materials, reducing losses by keeping these resources circulating longer in the economy and recapturing their value at the end of a product's lifetime. Safe and environmentally-sound circular business models can help cultivate innovation, reduce GHG emissions and pollution, address social and environmental inequalities, restore damaged ecosystems, and create more resilient jobs.

While the economic opportunities and potential environmental and social benefits are significant, major challenges must be addressed to accelerate the transition to a circular North America. It is important to consider the barriers and key drivers that were discussed in the previous section as inter-linked. Factors that include culture, policy, innovation, investment, and collaboration all influence one another. As such, the drivers and enablers must be considered as an interconnected system rather than as separate pillars when looking to address the challenges and achieve success.

As part of its journey toward a more circular economy, North America has an opportunity to test and refine circular economy assumptions and better understand the untapped benefits, including in areas such as cross-border collaboration and trade. It will be important to consider where industry 'growth' is projected within each country, and across the region as a whole, and apply circular thinking to these areas as a priority. It is also important to consider the circular economy from multiple contexts – urban and rural, culture and diversity, and the unique strengths for the North American economy in terms of the primary resource sectors and other key industries.

As a region, an overarching strategy could help to set direction, recognizing that implementation will be shared by many partners and at all levels. There are a number of examples for comprehensive circular economy policy strategies from around the world, as well as a number of more local and regional efforts in North America that can be built on and/or used as a template for broader scale-up.

While moving to a world with minimal waste will be challenging, the current COVID-19 pandemic shows that innovation and collaboration are essential when it comes to addressing global crises, and that transformation can happen when collective minds are put to the task. The same can apply for the circular economy transition, which, if successful, will create a thriving and resilient low-carbon economy for North America.

# Appendix: Case Studies

## Industry Partnerships, Collaboration & the Innovation Ecosystem

### REMADE Institute

A cutting-edge clean energy initiative is set to keep U.S. manufacturing competitive while circular. Selected by the U.S. Department of Energy, Rochester Institute of Technology's Golisano Institute for Sustainability (GIS) leads the Reducing Embodied-Energy and Decreasing Emissions (REMADE) Institute. REMADE will leverage USD 70 million in federal funding that is being matched by the equivalent in private cost-share commitments from industry and consortium members. The Institute will look to drive down the cost of technologies that are key to reusing, recycling, recovering, and remanufacturing materials such as metals, polymers, fibers, and electronic waste. The aim is to achieve a 50% improvement in overall efficiency by 2027. These measures could amount to billions of dollars in saved energy costs and improve economic competitiveness through advanced manufacturing techniques and small business opportunities, as well as provide training and jobs for American workers.

The REMADE Institute is dedicated to accelerating the adoption of the circular economy through sustainable manufacturing technologies that deliver concrete, near-term economic and environmental impact. The Institute will facilitate early-stage applied research and development for technologies that address cross-cutting challenges at each stage of material lifecycles and could dramatically reduce the embodied energy and carbon emissions associated with industrial-scale material production and processing. REMADE currently spearheads 39 promising collaborative projects that span the industry from recovering copper and precious metals in electronic waste to incorporating high amounts of recovered rubber materials into tires. Given that manufacturing currently accounts for 25% of U.S. energy consumption, such initiatives to support the development of a non-linear manufacturing ecosystem are critical for our low-carbon future.

[LINK TO MORE INFORMATION](#)

### Great Lakes / St. Lawrence Region Collaboration

Given the high proximity of businesses, intense resource demand and cross-border trade, the Great Lakes and Saint Lawrence Region (GLR) represents an opportune location for a regional circular economy. Collaboration has been paramount in addressing the associated barriers, infrastructure gaps for recycling and reuse, changing consumer behaviour, and necessary innovation. Driving momentum in this regard, the U.S. Chamber of Commerce Foundation and Navigant (a Guidehouse Company) produced a report on "Creating a Circular Economy in the Great Lakes Region." Drawing on available and forecast data, the report provides clear guidelines for companies operating in specific sectors to capitalize on circular principles to unlock competitiveness, innovation and growth. In addition to exploring current technologies, the report features best practices case studies from organizations including Kohler, Steelcase, Whirlpool Corporation, Clearwater Paper, Procter & Gamble, Sappi North America, WestRock, Schnitzer Steel, and Dow. These examples highlight circular leadership from three key materials (steel, plastics, and wood/paper) to galvanize action across sectors.

The binational Council of Great Lakes Region (CGLR) is another organization promoting collaboration and integrating economic and environmental agendas for the region, which is shared by the Canadian



provinces of Ontario and Quebec and eight states, from New York to Minnesota. In particular, the CGLR's soon to be announced Great Lakes Circular Economy Partnership, a key element of the organization's Circular Great Lakes program (<https://councilgreatlakesregion.org/circular-great-lakes-program/>), will focus on forging a future without waste in which a binational Great Lakes circular economy thrives. The GLCEP will initially set its sights on tackling plastic materials and the estimated 22 million pounds of plastics that enter the Great Lakes annually by ensuring critical materials are cycled through the regional economy and by facilitating regional projects with an emphasis on circular economy infrastructure, product and packaging innovations, consumer awareness, and capture and clean-up.

Thanks to Environment and Climate Change Canada funding, early successes that have been started by CGLR include: the launch of the Great Lakes Plastic Cleanup, with Pollution Probe and partners like the University of Toronto Trash Team ([www.greatlakesplasticcleanup.org](http://www.greatlakesplasticcleanup.org)), which employs Seabin and LittaTrap innovative technologies to recover plastic debris along the shorelines of the Great Lakes; and the creation of the Ontario Materials Marketplace Pilot, with the United States Business Council for Sustainable Development (<https://ontario.materialsmarketplace.org>), a facilitated transaction platform bringing businesses together to develop and scale new reuse and recycling market opportunities, not only in Ontario, but also between Ontario and marketplaces in the states of Michigan and Ohio.

[LINK TO MORE INFORMATION](#)

## **Plant Chicago**

Viewing waste as an opportunity at the outset, Plant Chicago sets a remarkable precedent for a closed loop system of food production, material reuse, and energy conservation. Established in 2011, this non-profit organization formed a collaborative community of food production businesses in Chicago's Back of the Yards neighbourhood. The initiative sought to displace linear food supply chains that neglect to utilize by-products, resulting in landfill and economic losses.

Over the eight years supporting The Plant Chicago project, the organization welcomed more than 60,000 people on tours and workshops at its facility and raised over USD 500,000 to support member businesses. By allowing companies to co-locate, as well as providing space and support to develop innovative food system methods, The Plant was able to capture materials from businesses on site. A material flow analysis over a three-month period in 2015 showed that an impressive 42% of the output materials were captured. The community also took steps to collect food waste from nearby industries to produce biogas for use on site, as well as repurpose and capture greater value from by-products. One such example is the spent grain from the brewery is being used as a growing medium for mushrooms. Their regenerative systems approach diverted over 10,000 tons of food waste from landfills annually and curtailed demand for natural gas.

The organization has now expanded its reach, renovating an abandoned firehouse as a center for circular economy programming which promotes a hands-on approach to research, development, and education. The new premises will offer an indoor aquaponic farm, shared mycology lab, and a refurbished center for the local circular economy. Plant Chicago coordinates educational programming (K-12) and their Local Circular Economy Leaders Network provides support for small businesses interested in collaborating to cultivate the local circular economy. They also coordinate weekly farmers' markets to support local farmers, processors, and small businesses. The initiative is a notable

illustration of a community-driven circular approach providing space that generates equity and economic opportunity for local businesses and residents.

[LINK TO MORE INFORMATION](#)

### **Metal Tech Alley: Reinventing Industrial Clusters**

Metal Tech Alley is a circular metals industrial economic development strategy, launched in 2017, underpinned by a cluster of heavy industry and high-technology companies from the West Kootenays region in Southeastern British Columbia – a region with a population of less than 10,000 people. The strategy was developed by the Lower Columbia Initiatives Corporation (LCIC) that builds on the region’s unique characteristics and assets, including the community’s strengths in metallurgy and technology.

Anchored by one of North America’s largest zinc and lead smelting and refining operations (owned by Teck Resources Ltd.) and an ecosystem of innovators and supporting agencies, Metal Tech Alley focused on reposition the region as a circular economy hub with leaders in:

- Metallurgy and advanced materials;
- Industrial recycling;
- Digital fabrication;
- Clean technology; and
- Industrial Internet of Things (IoT).

Metal Tech Alley is leading the fourth industrial revolution by building collective partnerships and supporting businesses at all stages. A key part of Metal Tech Alley’s progression has been the Selkirk Technology Access Centre or STAC (formerly known as the MIDAS Fab Lab), a public-private enterprise started by the Kootenay Association for Science and Technology (KAST), a non-profit regional organization dedicated to the technology sector; Teck Resources; and Fenix Advanced Materials, a private company experienced in the commercialization of metallurgical industry by-products. STAC supports academic research and development partnerships, business incubation services, and offers a dual sector fabrication lab and equipment in metallurgy and advanced/digital manufacturing.

Picking up where STAC leaves off, a recent addition to Metal Tech Alley is I4C, an international Industrial Internet of Things hub, and a production and testing facility. I4C supports early-stage Internet of Things qualified companies in research and development, light fabrication, commercialization, and/or distribution.

A great success of the initiative has been bringing together municipalities and businesses from the entire region around a common vision and consistent messaging. By unifying the message, the whole area is able to promote an overall vision, focused on circular economy, with greater impact than any one locale could have on its own.

[LINK TO MORE INFORMATION](#)

## **ECOCE Uniting Recycling Efforts in Mexico**

Ecología y Compromiso Empresarial (ECOCE) is a non-profit environmental civil association, created and sponsored by the consumer products industry (food and beverage) for the proper management of packaging and packaging waste in Mexico. ECOCE administers the National Plan for the Recovery of Post-consumer Containers and Packaging Waste (one of the twelve waste management plans, registered with the Ministry of the Environment and Natural Resources). The organization is made up of industrial groups that represent more than 300 brands of products such as soft drinks, mineral waters, purified waters, sports drinks, juices, sauces, dressings, condiments, and food.

ECOCE is focused on uniting efforts of the private sector, governments, and civil society to raise awareness, individually and collectively, to prevent the improper disposal and special handling of waste and materials, and to take advantage of the benefits from recycling. It does this through environmental education programs, communication campaigns, clean-up days, and informational events. Through the support of ECOCE's programs and initiatives, Mexico has become a global leader in the recycling of PET.

[LINK TO MORE INFORMATION](#)

## **U.S. & Canada Plastics Pacts**

Collective action, exemplified in national plastics pacts, is decisive to accelerate the transition towards a circular economy for plastics. The U.S. Plastics Pact brings together public-private stakeholders across the plastics value chain in a move to rethink how plastics are designed, produced, used, recovered, and reused. Recognizing that efforts must go beyond individual action, the U.S. Plastics Pact draws corporations, government, non-governmental organizations, and academia in a platform for industry-led innovation. Stakeholders can collectively meet impactful goals to advance plastic packaging to become reusable, recyclable, or compostable by 2025, as outlined in the Ellen MacArthur Foundation's New Plastics Economy Initiative. More than 60 activators across the supply and plastics manufacturing chain have already joined the U.S. Plastics Pact under the leadership of The Recycling Partnership, World Wildlife Fund, and the Ellen MacArthur Foundation. This signals a clear indication of the support for meaningful action on climate change as well as prevention of marine debris and waste management.

The Canada Plastics Pact will similarly align and mobilize national businesses, government, non-governmental organizations, and civil society with a goal to decouple waste and pollution from a thriving Canadian economy. Launching in the fall 2020, the initiative is working towards the same unified vision of a circular economy for plastics by innovating to ensure necessary plastics are reusable, recyclable, or compostable, and recirculating plastics through the economy. The pact aims to amplify expertise and capacity of Canadian stakeholders across the packaging value chain to ignite an industry-wide transformation towards circularity.

[LINK TO MORE INFORMATION \(U.S. Pact\)](#) and [LINK TO MORE INFORMATION \(Canada Pact\)](#)

## **The Canadian Plastics Innovation Challenges**

The Canadian Plastics Innovation Challenges (CPIC) are part of Canada's comprehensive approach to addressing plastic waste and pollution, an approach that works to keep plastics in the economy and out of the environment. As part of the Innovative Solutions Canada program, The CPIC provide funding to small and medium-sized enterprises to incentivize the development of technology to address plastic waste. Through this program the Canadian government is investing nearly CAD 19 million to support Canadian innovators to develop solutions for plastics challenges by providing winners with up to CAD 150,000 to develop a proof of concept and subsequently up to CAD 1,000,000 to develop a prototype if selected. CPIC Phase 2 winner Axipolymer will receive CAD 1,000,000 to create a recyclable multi-layer film that can be used for food packaging.

[LINK TO MORE INFORMATION](#)

## **Québec Innovation Ecosystem**

Québec provides a compelling example of how to foster a circular economy ecosystem by incorporating information sharing, capacity building, cross-sector collaboration, and supportive public policy. Québec Circulaire is a flagship initiative of the Pôle québécois de concertation, a voluntary group working to accelerate the transition to the circular economy in Québec. Their mission is to bring together previously dispersed initiatives, tools, and expertise into one resilient, expanding platform. This knowledge ecosystem acts as a real social network, supporting projects and multi-actor cooperation in the region. Québec Circulaire has also joined the international Network of collaborative platforms for the circular economy, which unites over 10,000 members and promotes nearly 1,000 projects. Integrated into a global network that is poised to grow, the Québec platform represents a promising collaborative tool to encourage dialogue and action. As work has been carried out largely in French with francophone networks, their experience remains to be transferred to the rest of North America.

In keeping with Québec Circulaire's synergistic approach, the province has integrated circular economy strategies into its legislation with a range of legislative and taxation tools to facilitate a circular economy transition. Public support has enabled studies to better understand the circular economy in a Québec context. Additionally, there is a community for industrial symbiosis projects in the region. Synergie Québec provides a network for industrial symbiosis projects in which strategic clusters of businesses exchange resources, waste, water, energy, and innovations.

[LINK TO MORE INFORMATION](#)

## **National Industrial Symbiosis Program (NISP) Canada**

Between 2017 and 2019, two 20-month National Industrial Symbiosis Program (NISP<sup>®</sup>) pilots were carried out in the Metro Vancouver and Greater Edmonton regions, including 12 workshops (2 in each region). The pilots were run as programs of Light House Sustainable Building Centre, a Vancouver-based not-for-profit, supported by International Synergies Ltd., the UK-based creators of NISP<sup>®</sup> – a model that has now been used in over 35 countries around the world.

The principle behind industrial symbiosis is quite simple; instead of being thrown away or destroyed, surplus resources generated by an industrial process are captured then redirected for use as a 'new' input into another process by one or more other companies, providing a mutual benefit or symbiosis.

Industrial symbiosis evolved as a theoretical means to achieve better environmental performance, but has proven to be a key, practical means for shifting businesses to a low carbon, circular economy.

As of June 2019, the NISP® Canada Pilot programs engaged more than 500 participants and organizations and resulted in:

- More than 1,900 specific resources discussed, and more than 3,500 resource matches (or 'synergies') made;
- CAD 6.3 million in direct economic impact (cost savings) to participating businesses;
- 23,800 tonnes of CO2e emissions avoided (equivalent to more than 5,000 passenger vehicles driven for one year); and
- 253,800 tonnes of waste diverted from landfill.

The NISP® Canada pilots were funded by public sector agencies including: Western Economic Diversification, Metro Vancouver, the City of Edmonton, City of Surrey, City of New Westminster, Innovate BC, BC Ministry of Energy and Mines, BC Ministry of Agriculture, and BC Citizen Services and Community Development (now BC Municipal Affairs and Housing). The NISP® Canada pilots have achieved an initial 7:1 return on government investment to date, based on the CAD 1 million invested by partners.

[LINK TO MORE INFORMATION](#)

## Local Government & Circular Policy Initiatives

### Circular Charlotte

The City of Charlotte, North Carolina, is setting the pace as the first American city to make a commitment to adopt the circular economy as a public sector strategy. 'Circular Charlotte' explores how Charlotte can successfully move on its journey towards achieving this bold ambition while achieving economic mobility. Charlotte's current 900,000 tons of annual waste represent a residual value of approximately USD 111 million per year. Motivated to address poverty and economic opportunity, Charlotte is adopting a comprehensive waste diversion strategy that could create more than 2,000 jobs while harnessing material that would otherwise be disposed as landfill. Co-created with stakeholders, the city has set a precedent to analyze its waste streams and address key issues impacting the entire city, namely economic and social mobility, as well as develop a roadmap that works for its citizens. The expectation is that Circular Charlotte will help revive the area and establish Charlotte as an epicenter for communities to learn how to recreate and innovate. This lays the groundwork for Charlotte's circular transition and advances it towards its aspiration as a zero waste and inclusive city.

[LINK TO MORE INFORMATION](#)

### City of Toronto Circular Procurement

The City of Toronto, Ontario, is demonstrating how to accelerate systemic change and drive market innovation through public purchasing power. Toronto's annual purchasing contracts amount to approximately CAD 2 billion, which can be leveraged to drive waste reduction and deliver economic and social benefits. The city's Circular Economy Procurement Implementation Plan and Framework is

doing just that as it pushes for zero waste in the city through a circular approach. In 2016, the City Council approved the Long-term Waste Management Strategy and formed a Cross-Divisional Circular Economy Working Group to develop a strategy for City procurement to drive waste diversion. The Framework outlines the city's circular economy procurement objectives as well as identifying numerous opportunities to leverage the city's buying power. Drawing on CAD 1.8 million in funding, the initiative may be implemented across target sectors including food and catering, waste management, textiles and clothing, information and technology, and construction and engineering.

[LINK TO MORE INFORMATION](#)

### **Reimagine Phoenix Strategy**

Leveraging participation in the circular economy, the City of Phoenix, Arizona, is working toward a concrete goal to create zero waste by 2050. Reimagine Phoenix is the city's initiative to divert 40% of its waste from landfills by 2020 and to better manage its solid waste resources going forward. More than a million tons of solid waste enters the city's landfill annually. To achieve its Zero Waste target, the city is supporting the transition to a circular economy and encouraging the retail industry to provide products that are either 100% recyclable or able to be repurposed at end of life. It is also centering considerable effort around recycling with the expansion of its current recycling program and by incubating local businesses to capture new products from the waste stream. Phoenix's Public Works Department offers solid waste programs to make waste diversion more convenient for residents and supports public-private partnerships to find solutions to sustainability issues.

The new Resource Innovation Campus and Compost Facility are concrete steps in this regard. In addition, the city's Zero Waste team provides education and community outreach to increase awareness of the importance of waste diversion and management. In parallel, Phoenix is addressing the 34,000 tons of palm fronds that find their way to the municipal landfill every year. Through a partnership with Palm Silage, a process has been developed to transform palm fronds into an ingredient for livestock feed. By looping back by-products and waste materials to create highly nutritious feed, Palm Silage not only creates a new \$10 million revenue business but also helps lower municipality disposal costs and has created local jobs. These measures are beginning to yield results. The waste diversion rate in Phoenix was at 20% in 2015 but reached 36% as of June 2019 and is expected to continue rising.

[LINK TO MORE INFORMATION](#)

### **New York City's #WearNext Initiative**

New York City's #WearNext collaborative campaign draws on expertise from the Ellen MacArthur Foundation's Make Fashion Circular initiative, fashion brands, recyclers, collectors, the New York City Department of Sanitation, and the New York City Economic Development Corporation to save the metropolis' clothes from landfill. This city-wide effort has far reach considering 200 million pounds of clothing end up in city landfills annually and the disposal of residential waste alone costs New York residents USD 300 million per year.

An online map created by New York City Department of Sanitation lays out over 1,100 collection points across the city where New Yorkers can take unwanted clothes. Compared to the same time period in 2018, collection volumes have increased by 583 tons across a number of city collection points.

Residents are not only able to drop off clothing at stores and other collection points, they are also encouraged to participate fully in a circular economy by donating, repairing, reselling or exchanging old clothes to extend their lifecycle. #WearNext has been successful in raising awareness about New York City's existing clothing collection infrastructure and indicates the potential of a circular economy for fashion and textiles.

[LINK TO MORE INFORMATION](#)

## Corporate Leadership & Innovative Business Models

### Algramo

Algramo demonstrates how innovators can design to meet increasing demand for convenient, economical, and waste-free customer solutions. This Chilean startup created a refillable dispensing system replacing single-use plastic sachets. Algramo was founded in 2012 based on a binary social and environmental mission. Algramo founder Jose Manuel Moller set out to address prohibitive prices and poverty tax impacting millions of low-resource families by allowing them to access their required amount of product without single-use packaging. In partnership with small business owners, Algramo gives consumers a superior option for acquiring cleaning products. Algramo's unique refillable packaging system enables families to purchase the exact quantity of products they need at bulk prices. It then recycles packaging at the end of life into new plastic feedstock. Algramo, which translates to "by the gram," integrates several circular principles such as refill, reuse, and optimized reverse logistics. The company recognizes that smart reusable packaging can help minimize the amount of waste created from other single-use options. Algramo not only makes the sustainable option cheaper but also more equitable and convenient. Further, brands who sell through the Algramo system can expect to see significant cost benefits from reduced packaging and optimized logistics.

Algramo now operates in over 2,000 stores in Santiago, reaching roughly 350,000 customers. It recently expanded to the U.S. where their smart refill model will supply affordable cleaning products without waste in New York City. In partnership with Closed Loop Partners, Algramo launched refill vending machine pilots across New York, dispensing cleaning products, including Clorox Splash-less Cleaning Bleach and Pine-Sol Multi-Surface Cleaner, Softsoap Liquid Hand Soap from Colgate-Palmolive Company, and hand sanitizer from EcoLogic Solutions. The company was selected to join Newlab's Circular City Studio that empowers urban tech startups to create an equitable, livable, and resilient New York. The ongoing aim is to ensure that this business model is applied in a way that is cost competitive, optimizes customer experience, easily integrates into small businesses, and accelerates systems change.

[LINK TO MORE INFORMATION](#)

### Unbuilders Deconstruction

Vancouver-based Unbuilders Deconstruction takes apart structures across Metro Vancouver and on Vancouver Island, salvaging materials for reuse, recycling, and upcycling. By 'unbuilding' homes by hand, the company can reclaim most items, including old growth lumber, doors, cabinets, wood frames, windows, fixtures, and appliances. This ensures that 90% of the lumber in a home is salvaged.

Unbuilders waste minimization rates are a testament to their proficiency. Their projects yield less than 5% waste on average and they hold the City of Vancouver's record, salvaging and recycling a rate of 99% on a single-family home. This means that Unbuilders can divert 50 tons of waste and salvage 10 tons of lumber on a single project. The layer-by-layer disassembly is followed by upcycling materials into the supply chain.

Unbuilders' CEO and co-founder Adam Corneil not only saw a need for transformation in the demolition industry but also recognizes the importance of ensuring his company stays cost-competitive with conventional approaches. As the bulk of wood is donated to Habitat for Humanity, clients receive a tax receipt for the entire value of the wood package, which can amount to thousands of dollars. Corneil also operates a separate company, Naturally Crafted, which capitalizes on reclaimed wood for use in home building and furniture. Depending on the project, wood salvaged during demolition loops straight back in during the rebuilding process on site.

The Unbuilders' circular vision of construction, in which deconstruction and remanufacturing displace demolition and disposal, has a vast reach. The demolition industry generates millions of tons of waste in Canada annually, 37% of which is valuable lumber. A standard home weighs close to 50 tons and far too often usable resources are discarded at the expense of customers. Companies addressing this issue now have support of Vancouver's recent Green Demolition bylaw. The rule requires 75% of the materials be recycled in homes built before 1950, representing approximately 70% of home demolitions. This is expected to divert 18,000 tons of wood and building material from landfills annually and signals a move towards sustainable innovation in the industry.

[LINK TO MORE INFORMATION](#)

## **Eon's CircularID**

A fashion-forward example of powering connected and circular commerce, CircularID™ is designed to promote circularity through a new standard on communicating fashion product information. Motivated to unlock a network for circular commerce and new revenue streams, New York software startup Eon established the CircularID Initiative in 2018. It connects global brands, products, customers, and partners across the entire product lifecycle. The CircularID Protocol notes essential product and material data and ensures this information remains accessible. Likened to a food nutrition label, CircularID provides a unique digital identity at production, building on traditional garment tags by displaying details such as brand, price, dye process, and recycling instructions. A log, known as the "passport," captures interaction data during the product's lifecycle. The digital ID is permanently linked to the product through technologies such as RFID, NFC, QR code, or UPC barcode. The protocol covers the continuous flow of the product through commercial business functions such as resale and rental, as well as disassembly and recycling.

Today's fashion industry is primarily characterized by a linear path of production through to consumption and waste with less than 1% of clothing being recycled into new clothing. Using the CircularID system, data is accessible to stakeholders throughout the fashion ecosystem which allows garments to circulate with maximum value retained for as long as possible before looping back through reuse or recycling.

H&M, Target, PVH Corp, Microsoft, Waste Management, and others have collaborated with Eon to power this profitable, circular model. CircularID encourages brands to consider the future recycling and re-commercing of their fashion products. It can help scale rental, resale, digital wardrobing, peer-to-



peer exchange, styling services, reuse and recycling, and could have a noticeable impact on fast fashion retailers as there is an incentive to produce longer-lasting items and possibly capitalize on future transactions. Together with Microsoft, Eon plans to bring 400 million products online by 2025 through CircularID and Microsoft Azure. This system unlocks data that not only encourages transparency and accountability but also extends product lifecycles and promotes recovery of materials.

[LINK TO MORE INFORMATION](#)

## **PetStar**

At the forefront of innovative recycling partnerships is PetStar, a prominent Mexican company dedicated to collecting and recycling PET (polyethylene terephthalate) containers. Its food grade PET recycling facility is the largest in the world, keeping Mexico's PET bottles in the recycling loop. This success has been the result of a fruitful alliance initiated by Mexican environmental services business Avangard. The intention was to close the loop by implementing a PET bottle-to-bottle recycling program completely within Mexico and generate a cycle of social, economic, and environmental benefits.

Backed by financial support from the World Bank's International Finance Corporation, a sophisticated recycling plant was constructed in Toluca, 40 miles west of Mexico City. The 250,000 square foot PetStar plant began operation in 2009 and was capable of recycling 27,000 metric tons of clear food grade resin each year. The plant's impact was large and, three years later, Coca-Cola invested to double PetStar's capacity and increase its recycling capability to 130 million pounds of PET annually.

Currently part of the Mexican Coca-Cola Industry, PetStar serves as an inspiring example of the achievements made possible through a circular economy. The company has collected over 84,132 tons of PET bottles and recycles 3,100 million bottles annually, resulting in 1,789 tons of recycled food grade PET resin. Based on circular economy principles, PetStar uses an Inclusive Collection Model which operates through eight collection plants strategically located throughout Mexico. Their team is rethinking the way waste is managed throughout the value chain and employs technology to value the flow of collected materials to be reincorporated into productive chains. The PetStar Reborn product has been recognized as the first PET recycled resin in the world to achieve Cradle to Cradle certification. This circular approach has helped position Mexico as a leader in PET collection with a rate of 56% and allows for over 53% of their collected bottles to be repurposed into food grade resin.

[LINK TO MORE INFORMATION](#)

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- <sup>22</sup> U.S. Environmental Protection Agency (2019). Materials, Waste and Recycling. See: <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management-0> and U.S. Environmental Protection Agency [EPA530-5-17-01](https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management-0)
- <sup>23</sup> Dieleman, Hans & Martínez Rodríguez, María. (2019). Potentials and Challenges for a Circular Economy in Mexico: Texts and Studies in the History of Philosophy, p.11
- <sup>24</sup> Circle Economy Circularity Gap Report for Norway. See: <https://www.circularity-gap.world/updates-collection/the-norwegian-economy-is-2-4-circular>
- <sup>25</sup> National Geographic (March 2020). Article entitled “The End of Trash”, p.50.
- <sup>26</sup> See: [https://ec.europa.eu/environment/circular-economy/pdf/new\\_circular\\_economy\\_action\\_plan.pdf](https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf)
- <sup>27</sup> <https://institute.smartprosperity.ca/sites/default/files/wpcirculareconomy.pdf>
- <sup>28</sup> Ibid.

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<sup>29</sup> International Monetary Fund (IMF), World Economic Outlook Database. See: <https://www.imf.org/external/pubs/ft/weo/2020/01/weodata/index.aspx>

<sup>30</sup> See: [https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/CMMP/CMMP\\_The\\_Plan-EN.pdf](https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/CMMP/CMMP_The_Plan-EN.pdf)

<sup>31</sup> <https://cca-reports.ca/reports/the-circular-economy-in-canada/>

<sup>32</sup> <https://www.worldatlas.com/articles/continents-by-population-density.html>

<sup>33</sup> Dieleman, Hans & Martínez Rodríguez, María. (2019). Potentials and Challenges for a Circular Economy in Mexico: Texts and Studies in the History of Philosophy. P.21.

<sup>34</sup> See: <https://www.northernpublicaffairs.ca/index/trash-talk-recycling-in-canadas-north-a-costly-challenge/> and <https://www.cbc.ca/news/canada/north/nunavut-ends-recycling-program-1.948558>

<sup>35</sup> International Resource Panel / UNEP (2018). [Redefining Value: The Manufacturing Revolution](https://www.unep.org/resources/report/defining-value)

<sup>36</sup> See: <https://corporate.walmart.com/newsroom/2020/09/21/walmart-sets-goal-to-become-a-regenerative-company>

<sup>37</sup> <https://www.greenbiz.com/article/can-apple-close-loop-tech-giant-targets-100-recycled-material>

<sup>38</sup> [http://www.cec.org/files/documents/strategic\\_plans/cec-strategic-plan-2021-2025.pdf](http://www.cec.org/files/documents/strategic_plans/cec-strategic-plan-2021-2025.pdf)

<sup>39</sup> <https://www.uschamberfoundation.org/best-practices/creating-circular-economy-great-lakes-region>

<sup>40</sup> For the United States, see Closed Loop Partners (2020). The Circular Shift: Four Key Drivers of Circularity in North America, available at: [https://www.closedlooppartners.com/wp-content/uploads/2020/09/The-Circular-Shift\\_Closed-Loop-Partners-2.pdf](https://www.closedlooppartners.com/wp-content/uploads/2020/09/The-Circular-Shift_Closed-Loop-Partners-2.pdf). For Canada, see Smart Prosperity Institute (2018). Getting to a Circular Economy: A primer for Canadian policy-makers available at: <https://institute.smartprosperity.ca/sites/default/files/spipolicybrief-circulareconomy.pdf>. For Mexico, see Dieleman, Hans & Martínez Rodríguez, María. (2019). Potentials and Challenges for a Circular Economy in Mexico: Texts and Studies in the History of Philosophy

<sup>41</sup> <https://www.globeseries.com/wp-content/uploads/2020/05/celc-globe-advance-workshop-report.pdf>

<sup>42</sup> [https://www.closedlooppartners.com/wp-content/uploads/2020/09/The-Circular-Shift\\_Closed-Loop-Partners-2.pdf](https://www.closedlooppartners.com/wp-content/uploads/2020/09/The-Circular-Shift_Closed-Loop-Partners-2.pdf)

<sup>43</sup> <https://www.oecd.org/environment/waste/policy-highlights-international-trade-and-the-transition-to-a-circular-economy.pdf>

<sup>44</sup> World Economic Forum reports and discussions. See: <https://www.weforum.org/whitepapers/facilitating-trade-along-circular-electronics-value-chains> AND [http://www3.weforum.org/docs/WEF\\_Plastics\\_the\\_Circular\\_Economy\\_and\\_Global\\_Trade\\_2020.pdf](http://www3.weforum.org/docs/WEF_Plastics_the_Circular_Economy_and_Global_Trade_2020.pdf)

<sup>45</sup> <https://www.ellenmacarthurfoundation.org/resources/apply/circulytics-measuring-circularity/other-tools>

<sup>46</sup> [https://docs.wbcscd.org/2019/09/WBCSD\\_Policy\\_enablers\\_to\\_accelerate\\_the\\_circular\\_economy.pdf](https://docs.wbcscd.org/2019/09/WBCSD_Policy_enablers_to_accelerate_the_circular_economy.pdf) AND <https://institute.smartprosperity.ca/sites/default/files/spipolicybrief-circulareconomy.pdf>

<sup>47</sup> OECD (2016). Policy Guidance on Resource Efficiency report.

<sup>48</sup> Smart Prosperity Institute.

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<sup>50</sup> See: [https://ec.europa.eu/environment/gpp/pdf/CP\\_European\\_Commission\\_Brochure\\_webversion\\_small.pdf](https://ec.europa.eu/environment/gpp/pdf/CP_European_Commission_Brochure_webversion_small.pdf)

<sup>51</sup> [https://ec.europa.eu/international-partnerships/priorities/green-deal\\_en](https://ec.europa.eu/international-partnerships/priorities/green-deal_en)

<sup>52</sup> See: [https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/ce\\_booklet.pdf](https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/ce_booklet.pdf)

<sup>53</sup> See: <https://www.ellenmacarthurfoundation.org/assets/downloads/Cities-in-the-Circular-Economy-The-Role-of-Digital-Tech.pdf> and <https://www.sciencedirect.com/science/article/pii/S2212827117301452>

<sup>54</sup> [http://www3.weforum.org/docs/WEF\\_Harnessing\\_4IR\\_Circular\\_Economy\\_report\\_2018.pdf](http://www3.weforum.org/docs/WEF_Harnessing_4IR_Circular_Economy_report_2018.pdf)

<sup>55</sup> See: [https://www.ic.gc.ca/eic/site/101.nsf/eng/h\\_00000.html](https://www.ic.gc.ca/eic/site/101.nsf/eng/h_00000.html)

<sup>56</sup> <https://www.weforum.org/scale360-circular-innovation/home>

<sup>57</sup> Dieleman, Hans & Martínez Rodríguez, María. (2019). Potentials and Challenges for a Circular Economy in Mexico: Texts and Studies in the History of Philosophy. P. 10.

<sup>58</sup> UNEP FI (October 2020). Financing Circularity: Demystifying Finance for Circular Economies. See: [https://www.unepfi.org/wordpress/wp-content/uploads/2020/10/UNEPFI\\_DemystifyingFinanceCircularity-2020.pdf](https://www.unepfi.org/wordpress/wp-content/uploads/2020/10/UNEPFI_DemystifyingFinanceCircularity-2020.pdf)

<sup>59</sup> See: <https://www.eib.org/en/about/initiatives/circular-economy/index.htm>

<sup>60</sup> See: <https://www.blackrock.com/ch/individual/en/products/310165/blackrock-circular-economy-fund>

<sup>61</sup> Green Alliance (2019). Building a Circular Economy: How a new approach to infrastructure can put an end to waste. See: [https://www.green-alliance.org.uk/resources/Building\\_a\\_circular\\_economy.pdf](https://www.green-alliance.org.uk/resources/Building_a_circular_economy.pdf) AND Geizen, Mendel (2018). Shifting Infrastructure Landscapes in a Circular Economy: An Institutional Work Analysis of the Water and Energy Sector. See: [https://www.researchgate.net/publication/328028178\\_Shifting\\_Infrastructure\\_Landscapes\\_in\\_a\\_Circular\\_Economy\\_An\\_Institutional\\_Work\\_Analysis\\_of\\_the\\_Water\\_and\\_Energy\\_Sector](https://www.researchgate.net/publication/328028178_Shifting_Infrastructure_Landscapes_in_a_Circular_Economy_An_Institutional_Work_Analysis_of_the_Water_and_Energy_Sector)