



# CANADA

# 2030

## SUSTAINABILITY

### WHAT IF...

THE INTERNET OF THINGS FACILITATED THE  
DEVELOPMENT OF A CIRCULAR ECONOMY?



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## CANADA 2030 SERIES

Canada is experiencing significant social and technological changes that could disrupt many aspects of society. In this context, the next 10 to 15 years could be a transformative period for the relationship between Canada's government and broader society. This Insight is part of a series developed by Policy Horizons Canada on a variety of topics.

### WHO WE ARE

Policy Horizons Canada (Horizons) is a strategic foresight organization within the Public Service of Canada with a mandate to help anticipate emerging policy challenges and opportunities and to experiment with methods and technologies to support resilient policy development. Horizons is exploring plausible futures for Canada over the next 10 to 15 years in the areas of governance, sustainability, infrastructure, and the digital economy. With the active participation of experts from governmental and other organizations, Horizons identifies the key factors driving change, looks for potential surprises, explores plausible futures in the form of scenarios, and surfaces key emerging policy challenges and opportunities.

### VISUAL CONCEPT

The *Canada 2030* visual concept juxtaposes the past and the future in a subtle mix of colours, fonts, and imagery. The vibrant colour palette creates a safe space for the reader to open his or her mind. The main imagery found throughout the suite of products is rooted with the leaf of the sugar maple. The maple fruits, the samaras, gracefully fall throughout the Canadian landscape. They hold the potential of growing into trees and forever leaving their mark from coast-to-coast. Just like the Insights surfaced through the foresight methodology, they may one day be part of our reality. The traditional style of ink hatching accentuates the ribs of the leaves and evokes the system maps used in foresight. As we embark on Canada's 150<sup>th</sup> year, let us embrace our past and consider our plausible futures.

*This document does not attempt to predict the future. The purpose is to stimulate reflection and dialogue and support the development of public policy that is more robust and resilient across a range of plausible futures. The views contained in this document do not necessarily represent the views of Horizons, the Government of Canada or participating departments and agencies.*

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# WHAT IF...

## ... THE INTERNET OF THINGS FACILITATED THE DEVELOPMENT OF A CIRCULAR ECONOMY?

*The Internet of Things could accelerate the shift to a global circular economy, which may help address resource constraints, mitigate adverse environmental impacts and generate sustainable economic growth.*

### WHAT'S CHANGING?

A mere decrease of resources and energy used per unit of economic output does not address the finite nature of resources and the limits on the carrying capacity of the planet. According to the [World Bank](#), global waste generation will reach 6.5 million tons of solid waste every day by 2025. What if much of this waste could be repurposed and integrated back into the economy rather than going into the landfill?



Global waste generation will reach 6.5 million tons of solid waste every day by 2025



### THE CIRCULAR ECONOMY

Living within the earth's carrying capacity requires a deep shift in the current economic operating system, and the development of new systems of consumption, production and waste that aim to balance economic development and resource extraction – in effect, moving from a linear “take-make-waste” economy towards a circular economy. According to the [Ellen](#)

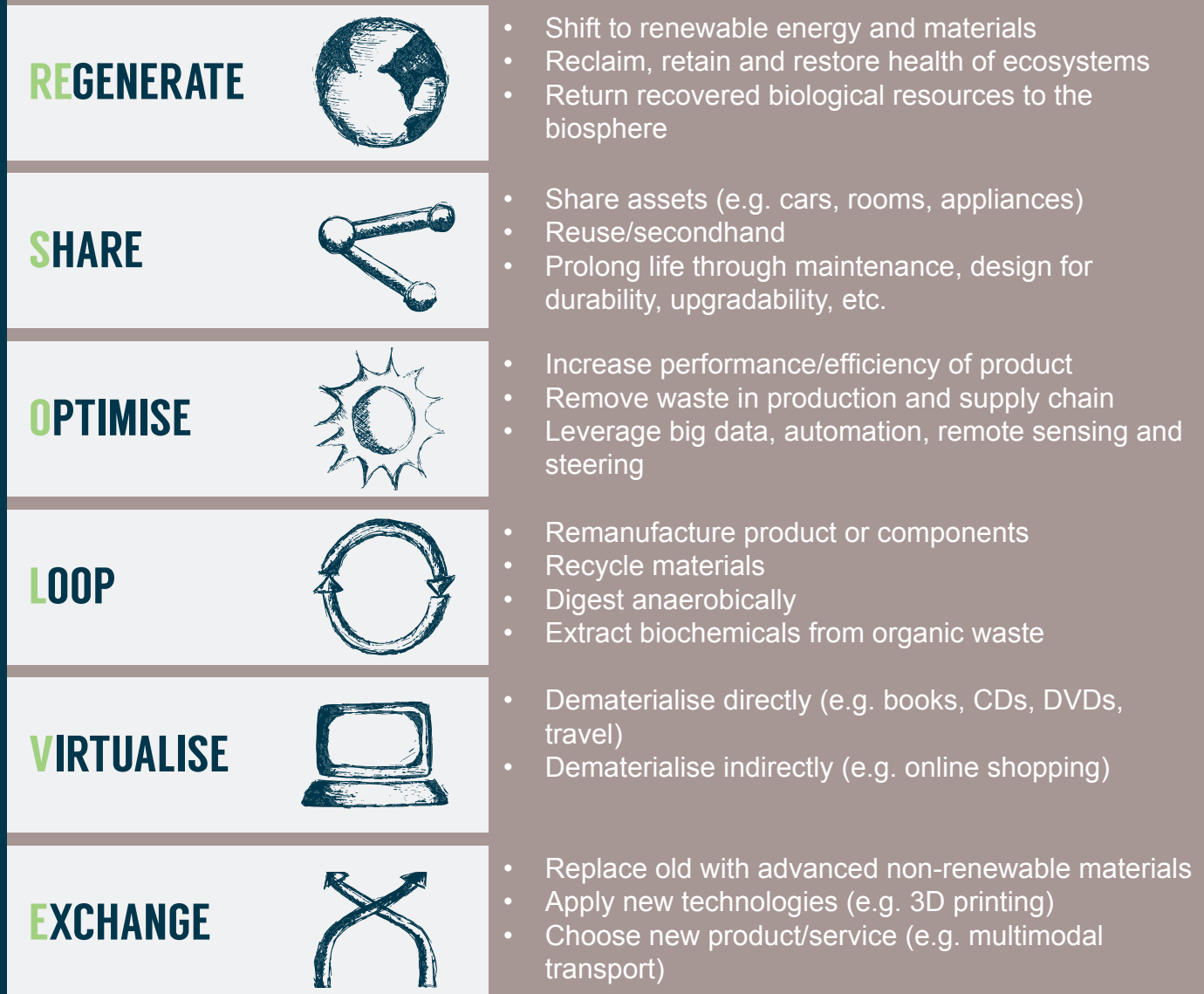
[MacArthur Foundation](#), the circular economy is “restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles.” The circular economy relies on [three core principles](#): preserving and *enhancing natural capital* through controlling non-renewable resources and balancing the flow of renewable resources (e.g., replacing fossil fuels with renewable energy); optimizing resource yields through remanufacturing, refurbishing and recycling processes that ensure components and materials are circulating in and contributing to the economy (e.g., extending product lifetimes); and *fostering system effectiveness* by minimizing the negative impacts on land use, climate change, pollution, toxins, congestion, and other externalities. The Foundation has identified six broad actions businesses and governments can take in the transition towards a circular economy ([see Figure 1 below](#)).

### ENLISTING THE POWER OF CONNECTIVITY

Shifting away from the linear economic model of “take-make-waste” that has been a pillar of the global economic system is no easy task. However, through optimizing the power of connectivity, the Internet of Things (IoT) could support the transition to a circular economy. Connected devices allow for the tracking of products, components and materials, which enable efficiency in recovery and re-use. Here are some examples of businesses that are at the forefront of this shift in using the IoT to address sustainability issues:

- Telecommunications giant, Vodafone has enabled “smart bins” that alert city authorities when they need to be emptied. In one city, these smart bins cut transport emissions of a refuse fleet by 18 percent.
- Solar Roadways has developed hexagon-shaped solar panels strong enough to handle the weight of vehicles and semitrailers and to form the surface of roads and sidewalks. These panels are integrated with lights and microprocessors to enhance efficiency. They may be used to direct traffic, as well as communicate with each other and other devices.
- Hewlett Packard (HP) has developed a business printer that uses the IoT to track how much ink is being used. When ink is running low, a new cartridge is sent to the customer, accompanied by a recycling bag to send back the used ink cartridge to HP, which is then repurposed.
- SEAT, a Spanish automobile company, has developed the ParkFinder app that collects information on free parking spots across a city. This app has the potential to save an average of 20 minutes of driving to find parking spaces in major European cities.

## FIGURE 1: RESOLVE FRAMEWORK



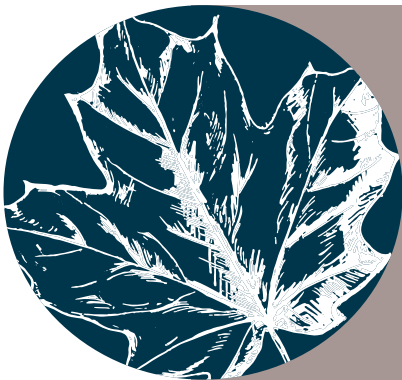
Source: Ellen MacArthur Foundation, 2015. *Towards a Circular Economy: Business Rationale for an Accelerated Transition*. Page 9

## THE EVOLVING INTERNET OF THINGS WITHIN A CIRCULAR ECONOMY

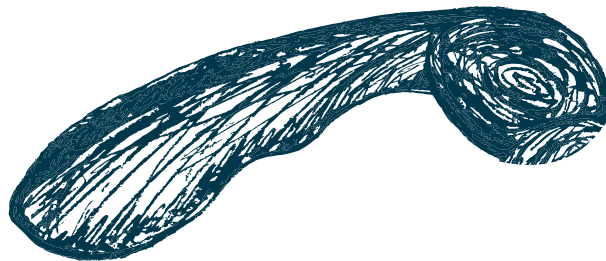
Ericsson estimates that 28 billion devices will be connected worldwide by 2021, and that over half of these devices will be connected through the IoT. While current connections are largely in the form of home and office information technology devices, as well as business and manufacturing devices, the future is likely to see several other types of connections, including buildings, vehicles, clothing, food, animals, plants, and so on. Goldman Sachs asserts that five key early areas of IoT adoption will include wearables, cars, homes, cities and industrials.

The IoT could reinforce the circular economy by allowing a level of monitoring that may shift the very foundation of the economic system in a way that could enhance efficiencies in production, consumption, recycling, waste and reuse. Some of these efficiencies include an increase in product performance, enhanced waste reduction during the production process and supply chain management, shifts to renewable energy and materials, and recycling and remanufacturing of products and components.

Enabled by the IoT, the circular economy could become a significant policy lever in generating sustainable economic growth, creating employment and reducing impacts on the environment.



*“At its core, the Internet of Things is a business model that reduces waste and streamlines processes, promising to deliver greater value from a smaller amount of resources.” – Triple Pundit*



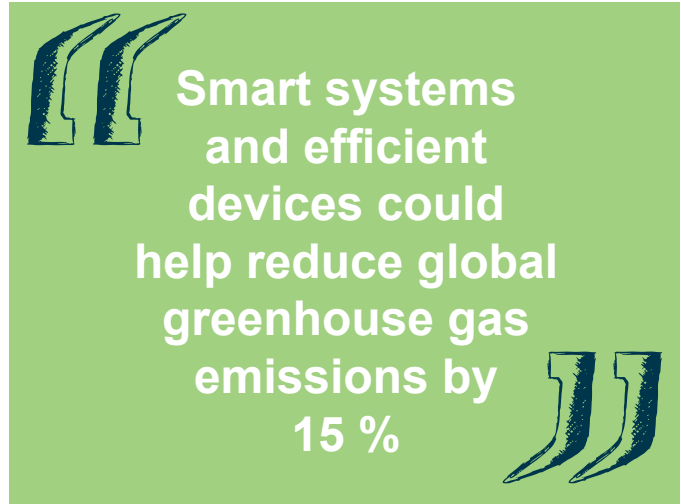
## POTENTIAL IMPLICATIONS

The transition to a circular economy, reinforced by the IoT, could hasten the shift towards a more sustainable economic paradigm. According to the [Ellen MacArthur Foundation](#), the circular economy could reduce operational waste and benefit the economy through considerable net material savings, reduced exposure to price volatility, mitigation of supply risks, increased potential for innovation and job creation, and enhanced resilience in living systems and the economy. Other potential implications include the following:

- **Global emissions:** Smart systems and efficient devices could help [reduce global greenhouse gas emissions by 15 percent](#). A report by Carbon War Room and AT&T indicates that global IoT implementation in agriculture, construction, energy, transportation and other sectors could result in over 9 gigatons per year reduction of global greenhouse gas emissions (equivalent to combined current emissions of India and the U.S.).
- **Current business models:** Slight adjustments to current business models could result in significant material productivity and profits.

[These may include](#) improvements in the selection of material, enhancements to product design, and the establishment of treatment and collection systems that are more cost-effective. It will be necessary to think of resources as assets rather than inputs and to maintain a relationship with customers during multiple cycles of production, consumption, waste and re-production. Businesses will also need time to re-adjust their processes and embrace a more circular system that helps maximize growth, savings and waste reduction.

- **Business models of the future:** Some businesses may choose to recover and re-condition products after use and then release them again into the market to earn a second or third income. For example, [Tata Motors Assured](#) refurbishes cars in Tata workshops, and puts these cars through a certification process before re-selling them. This approach may pose a challenge for some companies. For example, phone companies would need to manufacture phones that can be easily taken apart and to provide incentives for returning used phones. If this is done, the [cost of remanufacturing mobile phones](#) could be decreased by half. Businesses of the future may also use their design and remanufacturing capabilities to recondition products and their components in order to generate new products. In some cases, for example [BMW](#), this can result in 50 percent cost savings for customers buying remanufactured compared to new parts. Servicization could take root, where businesses sell the function of the product rather than the product itself or increase the service component of a product offer.
- **Government policy tools:** The European Union currently has a range of [policy tools](#) that may help foster a circular economy. For example, the [EU's waste legislation](#) incorporates measures to prevent waste, discourage landfilling, and enhance reuse and recycling. Also, the EU's [Bioeconomy Strategy](#) promotes the sustainable use of biological resources in the production of energy, food and bio-based products. Similarly, the [European Commission's climate policy](#) addresses energy conservation and greenhouse gas emission reduction. Although Europe is a leading region in recycling and reuse, challenges still remain in terms of



dematerialization (reduction in the quantity of materials required to serve economic functions in society). While the IoT could enhance the enforcement of the EU's current sustainability policies by enhancing monitoring and efficiency, it could also encourage further consumption.

- **No pain, no gain:** While some argue that the IoT may end up being a net benefit for the environment in the long-term, some short-term issues would need to be considered. Producing sensors, microprocessors and IoT-enabled devices will take additional raw materials and energy. The new devices will also replace old ones, which will need to be disposed of in an environmentally friendly manner.

