

# National Zero Waste Council Circular Economy Business Toolkit

Updated August 2021

# COUNCIL DESCRIPTION & ACKNOWLEDGEMENTS

The [National Zero Waste Council](#), an initiative of Metro Vancouver, is leading Canada's transition to a circular economy by bringing together governments, businesses and NGOs to advance a waste prevention agenda that maximizes economic opportunities for the benefit of all Canadians.

This is an updated version of the original 2015 Circular Economy Business Toolkit. The Council recognizes the contribution of Coro Strandberg, President of Strandberg Consulting, in the preparation and updating of this toolkit and the guidance of the Circular Economy Working Group in the 2015 version.

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# INTRODUCTION

The circular economy is an alternative to the predominant linear “take-make-use-waste” economy of production and consumption, which relies on large quantities of materials and inputs, and produces a lot of waste.



In a circular economy, manufacturers consciously design out waste and pollution at the outset, keeping products and materials in continual cycles of use and reuse, and regenerating natural systems. It offers fresh opportunities for businesses and communities to more effectively compete and function in a resource-constrained world and provides a systems-based approach to preventing waste.

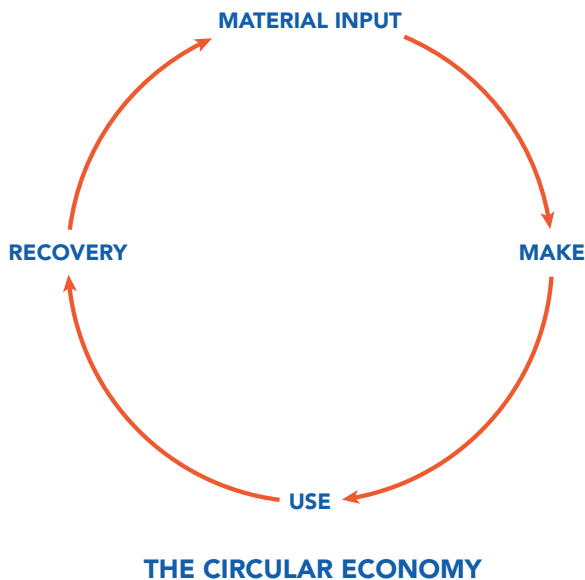
This toolkit is a how-to guide for businesses of all sizes, and sectors, to explore the opportunities of circular modes of design, production and service. It updates an earlier toolkit published in 2015.

The guide draws on a wide range of existing resources and research to define key terms, outline how businesses can benefit, and present case studies from around the world. References adapted for each chapter of the toolkit are listed at the back; additional resources are provided in each chapter.

The toolkit covers three key areas:

- **BUSINESS STRATEGY:** how to develop a circular business strategy;
- **DESIGN INNOVATION:** steps to include circular concepts in the design process; and
- **STAKEHOLDER ENGAGEMENT:** how to engage top stakeholders in the circular initiative.

While circular business practices often conserve water and energy, this guide targets the flow and use of materials up, within, and downstream of businesses, and does not focus on the water and energy benefits.



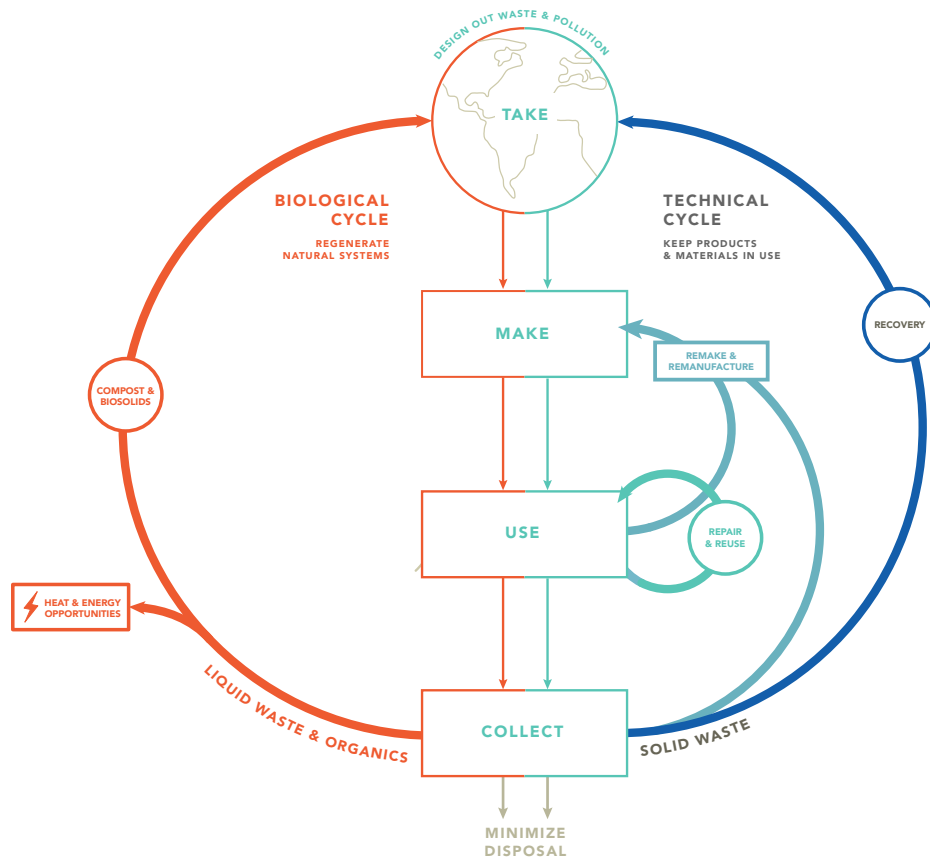
## What is the circular economy?

A **circular economy** is an economy that is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.

In practice this means:

- preventing waste through innovative business models or improved design – either for disassembly or durability;
- lengthening a product's life through enhanced re-use, repair or remanufacture; and
- improving end-of-life processing and resource recovery.

A circular business makes greater use of its physical assets, prolongs its life and draws more on renewable sources. The circular economy is regenerative by design, with a goal to retain as much value as possible from resources, products, parts and materials.



## Growth potential to 2030 in four linear economy waste streams\*

Peter Lacy and Jakob Rutqvist analyzed how the current linear economy can be reorganized to capture lost profits with a circular economy. Their book, "Waste to Wealth: The Circular Economy Advantage" identifies the major risks that supply disruptions, price increases and volatility will pose over the next 30 years. By 2030, these risks could already cost the global economy between \$3 to 6 trillion of growth.

When looked at from a circular opportunities lens, these risks are actually possibilities to recapture resources and pioneer new ways of providing goods and services. The graph below illustrates how \$4.5 trillion can be added to the global economy by 2030 through the practices of replacing wasted resources, monetizing wasted capacity, recovering wasted embedded values and preventing wasted lifecycles.

Replacing wasted resources means eliminating materials and energy that cannot be continually regenerated and are consumed and forever gone when used are removed from the value chain. Monetizing wasted capacity refers to the reclamation for sale of products that sit idle unnecessarily. Recovering wasted embedded values is the act of putting components, materials and energy that are not recovered from disposed products back into use. Preventing wasted lifecycles means to recover or redesign products with artificially short working lives or that are disposed of even if there is still a demand for them from other users.

### GROWTH POTENTIAL BY 2030 IN LINEAR WASTE STREAMS



ADAPTED FROM PETER LACY & JAKOB RULQVIST, ACCENTURE STRATEGY, "WASTE TO WEALTH: THE CIRCULAR ECONOMY CHALLENGE" (PAGE 30), SEPT 2015, PALGRAVE MACMILLIAN

## How can business benefit from a circular economy?

Pursuing a circular economy model future-proofs a company, improving its ability to predict its future and positioning it for further growth. Circularity is a trigger for continuous innovation, enabling a company to deepen its engagement with its business and customer base ahead of competitors.

A circular business can reduce risks and costs and increase revenues and profits through the following advantages:

- Developing new markets and customer segments, retaining and growing existing ones
- Satisfying changing customer needs and expectations and driving competitive advantage
- Reducing costs for the business, suppliers, and customers
- Increasing security of supply and maintaining access to resources
- Improving price stability and predictability of inputs
- Attracting, retaining and engaging employees – and new partners and allies
- Building company brand and reputation

- Getting ahead of investor requirements
- Anticipating government policy, regulation, and taxation models
- Reducing linear risk from business models based on the conventional economy
- Driving continuous rounds of product, process and business model innovation

A [rising driver of circularity](#) in business is the growing, urbanizing global population and the associated increase in consumption. “As the population grows and more consumers enter the middle class, the total demand for resources is expected to reach [130 billion tons by 2050](#), up from 50 billion in 2014. That’s an overuse of the Earth’s total capacity by more than 400%. Even factoring in run-of-the-mill technological improvements and resource efficiency, we’ll still be overusing around 40 billion tons of natural resources every year by 2050.” As a result of these forces, resource price volatility is predicted to become the new normal, greatly increasing the risk of inaction.

## Linear Risks

**Linear Risks** refer to a company's exposure to the effects of linear economic business practices. Companies that 1) use scarce and non-renewable resources; 2) prioritize sales of virgin products; 3) fail to collaborate or 4) fail to innovate or adapt – will be at risk of failing to continue as a going concern in the future.

Increasing expectations of the public, consumers and employees for companies to tackle world problems is another driver of circular business models. Thus, more and more businesses are using the United Nations' **Sustainable Development Goals** (SDGs), adopted by the global community in 2015, to guide their business priorities. The SDGs are a call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. Among the seventeen goals is **SDG 12: Responsible Consumption and Production**. This goal is most centrally aligned to circular business models, although becoming circular will advance many of the other goals, including climate action, life on land, life below water and zero hunger. Businesses that align their corporate goals to the UN SDGs are expected to realize business benefits from product innovation and customer, employee and investor attraction.

Finally, the global community is starting to measure and address the gaps in the world's progress toward circularity. As noted in the **third annual report** issued at the 2020 World Economic Forum, only 8.6% of the world economy is circular, and moving in the wrong direction. The report flags that we have hard-wired habits and business-as-usual behaviours that block system change. Decision-makers in business, government, and civil society are now mobilizing to put the economy on a better track. The evidence is gathering that becoming a circular business will help drive innovation and growth, attract partners and foster resilience.

Becoming circular is essential to long-term competitiveness and may be critical for a company's social license to operate and grow. The next three sections guide business leaders through a strategic approach to becoming circular.



**12 RESPONSIBLE CONSUMPTION AND PRODUCTION**



**TARGET 12-1**



IMPLEMENT THE 10-YEAR SUSTAINABLE CONSUMPTION AND PRODUCTION FRAMEWORK

**TARGET 12-6**



ENCOURAGE COMPANIES TO ADOPT SUSTAINABLE PRACTICES AND SUSTAINABILITY REPORTING

**TARGET 12-A**



SUPPORT DEVELOPING COUNTRIES' SCIENTIFIC AND TECHNOLOGICAL CAPACITY FOR SUSTAINABLE CONSUMPTION AND PRODUCTION

**TARGET 12-2**



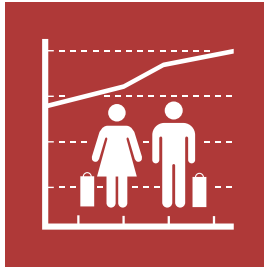
SUSTAINABLE MANAGEMENT AND USE OF NATURAL RESOURCES

**TARGET 12-7**



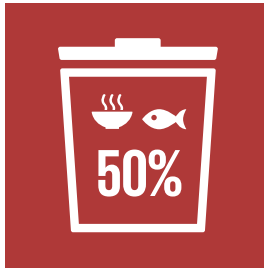
PROMOTE SUSTAINABLE PUBLIC PROCUREMENT PRACTICES

**TARGET 12-B**



DEVELOP AND IMPLEMENT TOOLS TO MONITOR SUSTAINABLE TOURISM

**TARGET 12-3**



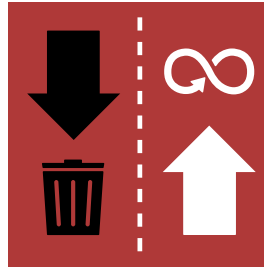
HALVE GLOBAL PER CAPITA FOOD WASTE

**TARGET 12-5**



SUBSTANTIALLY REDUCE WASTE GENERATION

**TARGET 12-C**



REMOVE MARKET DISTORTIONS THAT ENCOURAGE WASTEFUL CONSUMPTION

**TARGET 12-4**



RESPONSIBLE MANAGEMENT OF CHEMICALS AND WASTE

**TARGET 12-8**



PROMOTE UNIVERSAL UNDERSTANDING OF SUSTAINABLE LIFESTYLES



## BUSINESS STRATEGY

This section will help your business develop a circular strategy, by:

- Identifying strategic risks and opportunities for becoming circular
- Analyzing value chain opportunities
- Understanding and choosing business model options

There is no one-size-fits-all circular solution. Your approach will depend on several factors including your business model, sector, value chain, available resources and location. Start anywhere, but take a strategic approach to selecting your options. Here are some steps to tailor to your circumstances.

## Examine risks and opportunities

Hold a workshop with senior management and operations to uncover ideas for new business model applications.

Organize your workshop around five questions:

- **Linear Economy Risk:** What is the risk of continuing to operate in a linear fashion? What is our exposure to resource scarcity, a rise in commodity prices and environmental regulation over 3 – 5 years and 10 – 15 years? How can we diversify away from increasingly scarce resources? What circular options will become available in the future? What would our business look like in a circular world?
- **Value Chain Opportunities:** What opportunities exist for adopting circular economy approaches in our value chain? Are there inefficiencies and waste in the value chain we can minimize or eliminate? What value could we recover from products we have sold for the last 5 years? If we had to take back all the products we sold, how would that affect design and production?
- **Customer Value Creation:** What's the real value of what we deliver to customers and how can we create more value while rethinking how we deliver it? Can we reimagine how customers use our products or services? Can we help our customers increase the lifetime and utilization of our products? How does our business model need to change to capture the largest opportunities?
- **Technology and Industry Innovation:** What is the potential to disrupt our business model through technology trends including science, engineering and digital technologies? If our industry standardized and shared as much non- competitive material and infrastructure as possible, how much could our industry save?
- **Business Benefit:** What benefits can be realized in the short and long term? Considering the list of business benefits from the prior section, which are most relevant to our future prospects?

After exploring these questions your leaders should be sufficiently engaged to want these concepts developed further.

The following is a list of potential starting points for different sectors.

**Suggested priority areas for a selected number of industries.**

SECTOR	PRIORITY (EXAMPLES)
Agriculture	Improving soil fertility
Healthcare	Reduction of hazardous waste
Construction	Reduction of virgin materials
Waste Management	Minimizing down-cycling
Financial Services	Increasing the circularity of the portfolio
Mining	Leveraging urban mining
Manufacturing	Closing the materials loop
Transport and Logistics	Maximizing use and lifetime

**Analyze value chain opportunities**

An important early step is to understand your value chain and the monetary value of your existing waste stream. To do this, you could analyze the lifecycle of your product or service, or conduct a waste audit of your operations. A cost-effective approach is to conduct a high-level assessment of material flows in and out of your building or operations, looking upstream to source inputs and downstream to the customer use of your product and how the product is disposed of after use. Some refer to the value chain

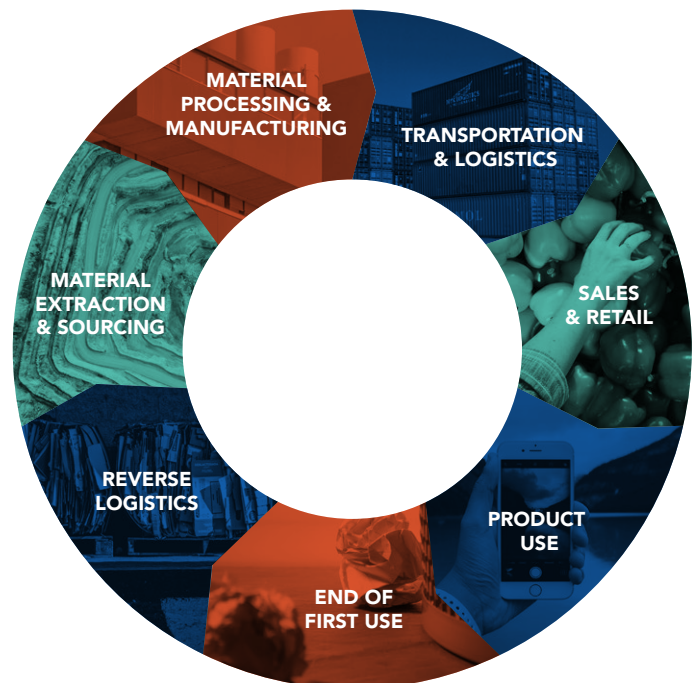
as a “value cycle”, as that is how the linear value chain begins to look in a circular economy.

Here is a simplified value chain model to help with this exercise:

1. At each stage in your value chain ...

- Determine the physical inputs required, inventory chemicals and materials, and assess the nature and volume of the waste generated and whether it could be useful to others, or monetized.
- Organize a professional waste audit or administer your own estimated waste audit. This can be done by connecting with your customer base to understand how long they are using your products and what they are doing at the end of life/disposal stage. Consider if there is a procurement alternative to frequently disposed items or reuse/upcycling opportunities.

**CIRCULAR SUPPLY CHAIN**



- For products that are landfilled, find out why. Has the user lost interest? Are there visual defects? Does it no longer function? Understanding why a product is thrown out will give you insights into what improvements can be made.
2. Now, go back to the drawing board and review every element of your design, manufacture, supply and packaging process to close important loops, including selecting the right source materials and designing for repair and disassembly. Set up an internal group to meet regularly to explore ways to minimize waste and ensure waste that is generated is put to the best possible use.

Not all loops are as easy or as important to close as others, so choose the products and loops where the impact is the greatest. This might mean prioritizing your own brand products, where you have responsibility for end-of-use management, or prioritizing loops with higher-value materials and sufficient volumes to make it efficient to close them.

If you are investigating a new use for material streams make sure you have sufficient volume and purity, two critical factors in developing a viable reuse plan. For materials and products not available in sufficient volume, consider partnering with companies through existing relationships or industry associations to increase total volumes. Or look to third party services to manage that aspect of the closed loop supply chain for you.

Here are some examples of partnerships to drive volumes and the business case:

- Vancouver-based [ChopValue Micro Manufacturing Ltd.](#) upcycles used sushi restaurant chopsticks into furniture, décor, gifts and accessories. Restaurants can partner with Chop Value to close the loop on these single use items.
- Belgian company [Umicore](#) started out as a mining and smelting 200 years ago and today is a materials technology and recycling company addressing resource scarcity and vehicle electrification trends. In 2019 it announced a sustainable battery recycling partnership with Audi, completing the test phase of their strategic research co-operation. The companies are partnering on a fully closed loop for cobalt and nickel, with the recovered materials used in Audi's new battery cells.
- [Germany brand I:CO](#), short for I Collect, is a global service provider for the in-store collection, re-use and recycling of used textiles and shoes – in other words, a global take-back system for fashion retailers. I:CO manages logistics, sorting and recycling in more than 60 countries. Clothing and shoes are sorted by hand and categorized based on their next best possible use, whether reuse or recycling. Wearable items are sold as second-hand goods and recycled textiles are used in denim and insulation for the automotive and construction industries. By partnering with I:CO, retailers benefit from its economies of scale.

3. Document your existing circular practices and see how you can build on and scale your prior knowledge and experience. Chances are you are already using recycled content in your procurements, offering your customers a product-take-back option, reusing decommissioned materials, and donating surplus office furniture. By analyzing your existing efforts, you can likely find an opportunity to accelerate and amplify on what is already working – this is an approach in which your business goes from 1.0 to 2.0 in its circular transformation.
4. Initiate collaborative projects to understand the causes – and opportunities – of waste across your value chain (cycle) and operations. Marks & Spencer, a global retailer, took this approach early in its circular economy journey. The company set an initial goal to complete a review of circular economy opportunities across all parts of the business to identify the commercial viability of reusing waste materials. It set a second goal to conduct a series of collaborative projects to address the causes of food waste across its supply chain and operations and eventually set a 2020 reduction target to guide its approach. The initial 2020 target was later updated to halve food waste (net relative to sales) in its own stores and ensure all edible food waste is redistributed via collaboration with its charity partners by 2025.

## Analyze business model options

Your value chain research will likely reveal immediate opportunities and suggest new business models. Seize those immediate opportunities to generate enthusiasm among employees and customers, then build momentum and support more transformative changes to your business model.

Below are five business models suggested by [Accenture](#) that underlie most circular business innovations. They can be pursued singly or in combination. Determine which are relevant and will help your business achieve resource productivity gains, enhance differentiation and customer value, generate new revenue and reduce risk.

If developing a new circular business model, your company will need to decide whether to establish this by acquisition or joint venture, collaboration with partner companies such as suppliers, customers or haulers, or by organic growth and investment.

1. **CIRCULAR SUPPLY CHAINS** are where recycled, recyclable or renewable materials are used as inputs instead of non-renewable resources, lessening dependence on scarce resources and reducing waste.
2. **PRODUCT AS A SERVICE** replaces ownership models with usage models, such as selling driving time instead of cars. This encourages companies to maintain products for longer and offers new services, such as long-term repair and maintenance. Refer to the Philips Light as a Service and FROGBOX case studies in [chapter 5](#).
3. **PRODUCT LIFE EXTENSION** refers to extending the lifecycle of products and assets through repair, upgrade, remanufacture or remarketing. Refer to the Enviro Image Solutions case study in [chapter 5](#).
4. **SHARING PLATFORMS** use digital technologies to maximize the use of underused assets and increase the utilization rate of products by making possible shared use, access or ownership. Hotel rooms, vehicles and consumer goods are examples. According to Accenture, 80 percent of typical household items are used only once a month. Refer to the Toronto Tool Library and BMW Share Now case studies in [chapter 5](#).

5. **RECOVERY AND RECYCLING** reclaim useful resources from disposed products or by-products. Some companies already re-use 100 percent of the waste generated at their manufacturing plants. Refer to the Enterra Feed Corporation case study in [chapter 5](#).



### IKEA's Circular Makeover

In 2018 IKEA set a goal to become a fully circular business by 2030. To achieve this business model transformation, the company is shifting how it develops products and services, sources materials, develops its supply chain and meets customer needs. It is defining what the four circular loops of reuse, refurbishment, remanufacturing and recycling mean for the development of its entire value chain. A key milestone on this journey is the publication of its [Circular Product Design Principles](#) to guide product development, to be in place by 2022. Material Roadmaps have also been created to deliver IKEA's 2030 goals, while the company is following its new Chemical Strategy to guide its work with chemicals. By 2030 the global furniture manufacturer plans to use only renewable or recycled materials (following ISO 14021 guidelines for environmental labels and declarations), and to enable its customers to acquire, care for and pass on products in circular ways, reaching 3 billion people. Among its recent circular successes, the company patented "click technology" allowing customers to assemble furniture with a series of clicks that does not require the use of glue or tools.

## Set Goals and Invest in Implementation

To advance on its circular path, a business needs to invest in implementation. Responsibility should be assigned to a senior leader, with goals and targets identified, measured and monitored. These should encompass business and societal goals such as waste diversion, greenhouse-gas emissions reduction, and job creation (both entry level and professional). You may also wish to define the new skills, roles and jobs needed for effective execution. For example, the company's waste manager may become a commodity manager with a mandate to find alternative value from manufacturing by-products.

To help companies set their circular goals and targets, the Ellen MacArthur Foundation launched a measuring tool, [Circulytics](#). This resource is designed to:

- Measure a company's entire circularity, not just products and material flows
- Support decision making and strategic development for circular economy adoption
- Demonstrate strengths and highlight areas for improvement
- Provide optional transparency to investors and customers about a company's circular economy adoption
- Improve clarity about a company's circular economy performance, opening up opportunities to generate brand value with key stakeholders



Other [measurement resources](#) include:

- [Cradle to Cradle Products Innovation Institute](#) — The fourth version of the Cradle to Cradle Certified Product Standard features an updated Product Circularity category, focused on sourcing, design and systems.
- [Global Reporting Initiative \(GRI\)](#) — GRI will be the first global standard that includes principles of circularity into waste disclosures, shifting the waste framing from an unwanted burden to a holistically managed material.
- [UL Environment](#) — Companies can pursue certification of UL 3600, which measures and reports on the circularity of products, facilities and organizations.
- [U.S. Green Building Council](#) — In late 2019, USGBC launched a circular economy pilot credit in its LEED rating system, which includes considerations of supply chain circularity, zero waste manufacturing, circular design and closed-loop systems.
- [World Business Council for Sustainable Development \(WBCSD\)](#) — WBCSD's Circular Transition Indicators provides a framework to assess a company's circularity, and quantify the value of shifting towards more circular approaches.

## Circular Culture

Your company's leadership and culture need to embrace and reward circular innovation because circular models require a fundamental rethink of how companies create value.

Include creative thinkers in your innovation teams - people who look at large systems from a fresh point of view. These should be people who can spot underutilized assets, cost inefficiencies, systemic malfunctions, negative consequences, externalized costs, constraints and the solutions to be found in nature's approach to design. It will be necessary to challenge conventional business models and entrenched behaviours.





### What does the circular economy mean for companies that make products?

Product brand-owners have an important role to play. They can ensure products are designed and manufactured with minimal impact to the environment throughout the product's life cycle. They can also offer value-added services such as repair/maintenance, reuse/redistribution, refurbishment/remanufacture and selling products as a service.

### What does the circular economy mean for retailers and distributors?

Product retailers and distributors have the opportunity to sell the best products initially and also deliver added-value services such as those described above. These foster closer relationships with the customer and opportunities at every stage of the product's lifecycle.

See more implications for sectors [here](#).

## Business Model Innovation in Plastics: Unilever Sets Goal to Become Plastic Neutral

In late 2019 [Unilever](#), owner of brands such as Dove, Ben & Jerry's and Lipton, committed to an absolute plastic reduction goal across its entire consumer goods portfolio. By 2025 it plans to:

- Halve its use of virgin plastic, by reducing its absolute use of plastic packaging by more than 100,000 tonnes and accelerating its use of recycled plastic.
- Help collect and process more plastic packaging than it sells (around 600,000 tonnes of plastic annually), to be delivered through investment and partnerships which improve waste management infrastructure in many of the countries in which it operates.

Unilever adopted these goals on top of existing goals to ensure all its plastic packaging is reusable, recyclable or compostable by 2025, and to use at least 25% recycled plastic in its packaging, also by 2025. According to the CEO: “This demands a fundamental rethink in our approach to our packaging and products. It requires us to introduce new and innovative packaging materials and scale up new business models, like re-use and re-fill formats, at an unprecedented speed and intensity.”

Since 2017, Unilever has been transforming its approach to plastic packaging through its ‘Less, Better, No’ Plastic Framework:

- Through ‘Less Plastic’ Unilever has explored new ways of packaging and delivering products - including concentrates, such as its new Cif Eco-refill which eliminates 75% of plastic, and new refill stations for shampoo and laundry detergent rolled out across shops, universities and mobile vending in South East Asia.
- ‘Better Plastic’ has led to pioneering innovations such as the new detectable pigment being used by Axe, which makes black plastic recyclable, as it can now be seen and sorted by recycling plant scanners, and the Lipton ‘festival bottle’ which is made of 100% recycled plastic and is collected using a deposit scheme.
- As part of ‘No Plastic’, Unilever has brought to the market innovations including shampoo bars, refillable toothpaste tablets, cardboard deodorant sticks and bamboo toothbrushes. It has also signed up to the [Loop Platform](#), which is exploring new ways of delivering and collecting reusable products from consumers’ homes.

By investing in innovation and partnerships, Unilever is transforming its business model to close the plastic loop.

## Resources for Business Strategy

[CEO Guide to the Circular Economy](#), World Business Council for Sustainable Development

[Circular Economy Toolkit: Resources for an Evolving World](#). University of Cambridge, 2013. Online assessment tool to help businesses prioritize circular economy opportunities.

[Linear Risks](#), World Business Council for Sustainable Development

Products that Last: Product Design for Circular Business Models. Bakker et al., 2014. Practical guide to understanding a product's afterlife and opportunities to develop circular business models.

[The Road to Circularity](#), PwC

[The New Big Circle](#), World Business Council for Sustainable Development and Boston Consulting Group

Waste to Wealth: The Circular Economy Advantage. Peter Lacy and Jakob Rutqvist, 2015. Introduction to circular economy business benefits and strategies.



## DESIGN INNOVATION

This section will help your business understand how to embed circularity into design, with guidance for:

- Including designing for circularity
- Next generation design methods
- Using reverse logistics in the design phase

By applying a circular lens to all stages of production and consumption, up and down the value chain, new opportunities for innovation can be recognized and realized.

## Designing for circularity

Design and product development are different in a circular economy. The focus shifts to designing for many lifecycles, uses and users, while optimizing the positive environmental effects of the materials used and minimizing or eliminating the negative environmental effects. Products can be adapted to generate revenues not only at point of sale but also during use. A low-cost return chain and a standard approach to reprocessing and tracing product chemicals and parts are needed.

One single circular innovation can be a gateway to many add-on customer benefits and features, whether sustainable or not. To modify your product development for circularity, consider the following:

- Begin design with the end in mind. Embed circular principles in the design brief, and as criteria in your innovation processes to encourage thinking about end-of-use recovery from the start. See [IKEA's Circular Product Design Principles](#) and [Walmart's Recycling Playbook](#) for examples.
- Hold workshops with designers, business strategists, and suppliers to map the entire value proposition of a product to see what needs to change and how.

- In material selection, use simple mono-material components. Assess which materials can be recycled, taken back as nutrients, or phased out.
- Determine which business partners are needed and engage them in your design process.

### Design Questions

- What would nature do in designing this product? (See [Biomimicry](#))
- What do our customers value? (See [Human-Centred Design](#))
- How can our product provide a net benefit to society? (See [Social Innovation](#))

## Inspired by Nature

As the Pacific Ocean swirled around him, a question rushed into Dr. Kaichang Li's head: how do mussels keep their grip on rocks that are constantly pounded by waves? Dr. Li, a professor at Oregon State University's College of Forestry, found that mussels secrete proteins known as byssal threads, which provide superior strength and extraordinary flexibility. His curiosity led to groundbreaking research –funded by Columbia Forest Products and others – based on the principles of biomimicry, which studies nature and then imitates its designs and processes to solve human problems.

Dr. Li discovered that soy proteins can be modified to perform similarly to byssal threads. And not only did they deliver phenomenal adhesion, they also offered exceptional water resistance. This breakthrough led to the development of the [PureBond product](#).

Since 2005 Columbia Forest Products has been manufacturing its hardwood plywood using a formaldehyde-free adhesive derived from food-grade soy flour and a wet strength resin used in printed currency and milk cartons. This proprietary assembly system is cost-competitive with urea formaldehyde-based plywood products. There is no added formaldehyde in the lamination or core assembly processes. In 2009 the California Air Resources Board (CARB) exempted PureBond from routine formaldehyde emissions testing.

The plywood can be specified using Forest Stewardship Council (FSC) materials. While green building products can often remain niche, PureBond® is readily available to retail customers through Home Depot.

In addition to PureBond®, Columbia Forest Products, an employee-owned company, provides a number of other building products with sustainability features including renewable and recycled content.

## Circular Design Principles

The National Zero Waste Council's [Key Design Principles for Waste Prevention & Systems-Thinking](#) is a tool for businesses to consider design for circularity across a product's life-cycle – breaking design principles into pre-use, during use, and post-use. The Design Guide reflects industry design principles, which can work individually or in combination.

To equip your business and your customers for a circular future, apply these criteria to your product portfolio:

- Durability
- Standardization and compatibility
- Ease of maintenance and repair
- Adaptability and upgradability
- Disassembly and reassembly
- Reuse, remanufacturing and remarketing
- Recyclability
- Customer attachment and trust, so products are loved, liked or trusted longer

## NATIONAL ZERO WASTE COUNCIL DESIGN PORTFOLIO – Celebrating Canadian Design for Waste Prevention

Want more design inspiration? Check out the Council's Design Portfolio, showcasing products and packaging that prioritize waste prevention while showing what a successful market solution looks like. These products demonstrate that businesses can find cost-savings, reduced environmental impacts, and increase consumer appeal by designing differently.



Keilhauer



Viva



Steelcase

Becoming a circular business requires an innovation mindset.

## Next generation design

When innovating for circularity, it is important to take whole product systems into account. To help with this, include people who source, design, make, sell, use and recover your materials and products, as well as your business strategists, on your design team. Your materials scientists, physicists and engineers and operations and logistics staff could have valuable contributions to make to the new design.

Consider establishing a collaborative innovation lab, which brings together stakeholders to develop a common understanding of a problem and co-create solutions. Some companies use open innovation platforms to crowd-source ideas from employees, suppliers, customers or the broader public. Unilever, a global consumer goods company, for example, maintains an Open Innovation Portal of its "challenges and wants". One of its challenges, called "More for Less", seeks technologies and materials that can be incorporated into products to deliver the same or better functionality while using radically less material. Examples include providing containers with a new purpose, a decrease in thickness or weight of packaging, or the ability to refill content. The desired outcome is improvement in packaging functionality while reducing the amount of material either in the final package or reducing the amount of material used in production. Established suppliers, start-ups, academics, designers, individual inventors and others are encouraged to submit ideas online.



Once a potential circular product or process has been identified, it may be necessary to undertake product development trials, initially at a demonstration scale and then at a commercial scale, to test the solution in the marketplace.

Try shortening the time to market and validate consumer preferences through rapid prototyping—a cost-effective demonstration and scaling process. This provides quick feedback from customers, stakeholders and employees, honing an innovation over several rapid cycles of design. While conventional approaches involve heavy up-front investment, a big launch and little room for experimentation, rapid prototyping starts with a simple “good enough” version of the product or process and invests in rounds of learning, development and fine-tuning based on feedback.

## Reverse logistics

For some business models, it is necessary to determine how to get the material back via reverse logistics. Reverse logistics refers to the movement, collection, treatment and redeployment of used or surplus resources, including hauling, sorting, warehousing, de-packaging, disassembly, end-of-use segmentation and related infrastructure. Reverse chains must be effectively conceived early in the design process to manage take-back and buy-back.

## What is Reverse Logistics?

**Reverse logistics** is the process of moving goods from their point of consumption to a consolidation point for the purpose of capturing value or proper disposal. It encompasses the collection of goods, transportation to a central location, and sorting according to ultimate destination, e.g. remanufacturing, refurbishing, reusing or recycling. By closing the loop of product lifecycles, reverse logistics plays an important role in the transition to a circular economy.

Quality control is central when determining the optimal return and reprocessing chain. Collection systems must be user-friendly, accessible to consumers, and able to maintain material quality. Having the right relationships in place will bring your circular venture to life. Talk to your end-processors early in the design phase to get their perspective, insights and buy-in.

New relationships and processes need to be developed, such as return through long-term contracts, customer incentives, mail-back, pay per use, etc. These models create valuable opportunities to develop loyal customers, moving from one-off transactions to deeper relationships, with more customer interactions and new opportunities to do business. **Mud Jeans**, a Dutch denim company, offers a leasing model for its designer jeans which is also nurturing a long-term relationship with its customers. The user benefits from use of the jeans while the company retains ownership of the raw materials, getting the jeans back for reuse and recycling via mail-back using RePack - a returnable and reusable packaging solution.



Retailers of new products can offer take-back services so that when buying a new product, the customer drops off their old one, either free of charge or in return for a credit on a new product. In this way, the retailer has direct access to the materials for reuse or sale in second-hand markets. Distribution depots can play a role in sorting and transporting the materials to their next use.

Another option is to mark products with a web link that connects the last owner to a central collection hub via a drop-off point or a freepost return service. Mobile phones and toner cartridges are collected in this way, fostering a profitable and environmentally beneficial remanufacturing industry.

## Reverse logistics essential to circular business model innovation

[Enviro Image Solutions](#) is a Canadian company that converts spent printing blankets used by printers from one-time consumables into multi-use assets. The company is extending the life of printing blankets by as much as 400 percent by maintaining ownership and utilizing reverse chains to get the blankets back after their first useful life.

Once a printer determines that a blanket can no longer be used it is crated and sent to the company for treatment. The company then ships the press-ready renewed blankets back to the plant. The printer retains ownership of the blanket throughout this process.

## Resources for Design Innovation

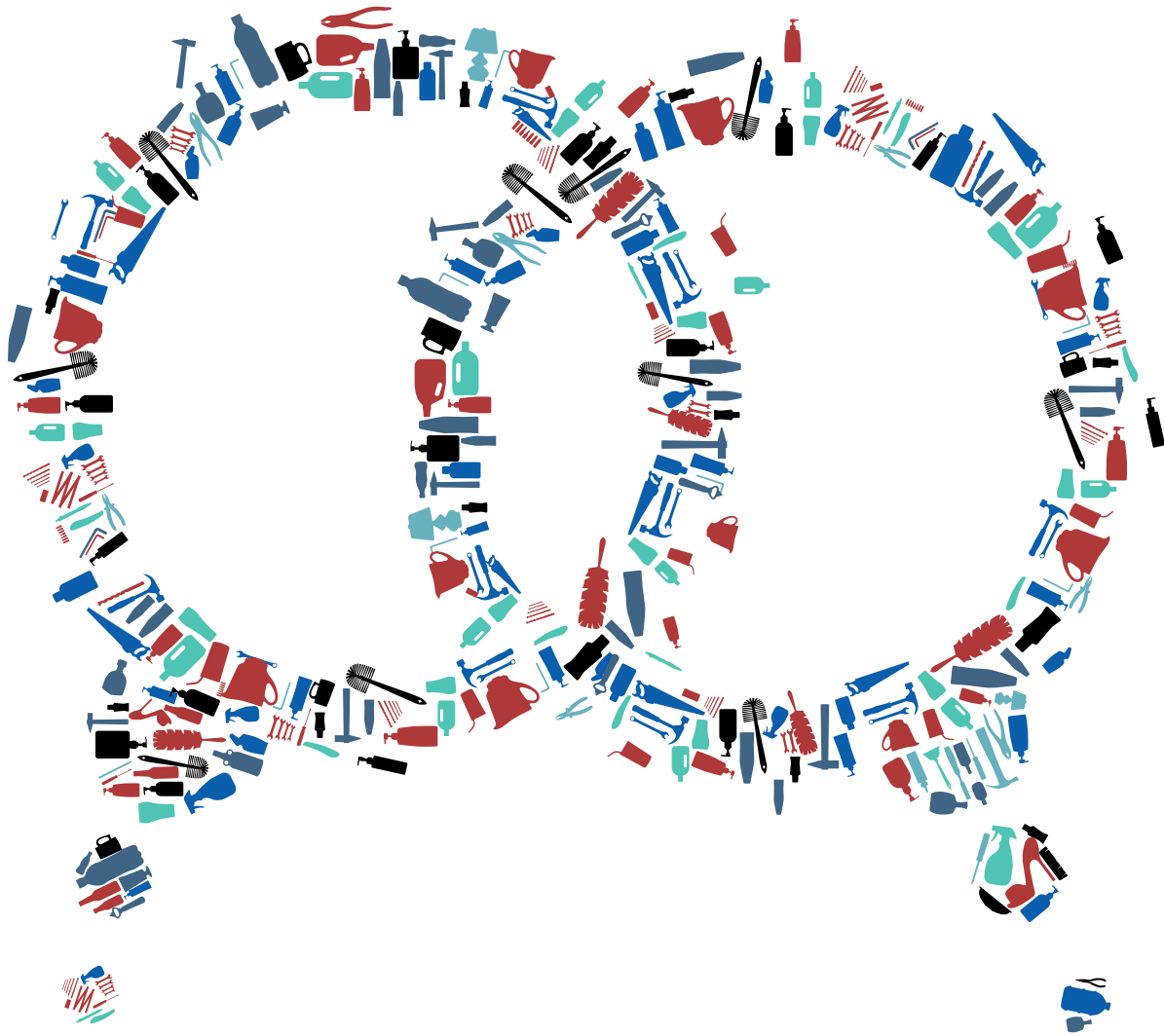
[Biomimicry Toolbox](#), Biomimicry Institute

[Circular Product Design Guide](#), IKEA

[Reverse Logistics in the Circular Economy](#), Philips Lighting

[The Circular Design Guide](#), Ellen MacArthur Foundation

[The Role of Design in the Circular Economy](#), Philips Lighting



# STAKEHOLDER ENGAGEMENT

This section will help your business engage stakeholders with tips on:

- Understanding the importance of engaging stakeholders
- Prioritizing stakeholders
- Engaging employees, customers, suppliers and industry partners

# A circular business requires everyone involved in its product supply chain to become practically involved in 'stewarding' the materials used in the product.

Mapping the value chain and the material flows in and out of your business will identify parties that help you bring your products to the market. By this point, you may have already included internal and external stakeholders in your processes to design new circular products and services as described in the Design section.

The Stakeholder Engagement section builds on these ideas, emphasizing the importance of stakeholder engagement in shifting to a circular economy and looking at key stakeholders to engage. This collaboration will help your stakeholders benefit from your circular innovations too — creating a virtuous circle in which all parties gain from the effort.

## Why engage stakeholders?

Engaging your stakeholders builds buy-in, creates the conditions for effective collaboration and helps uncover insights while fostering new habits and processes. Collaboration with suppliers, distributors, retailers, competitors, waste haulers, customers and others is needed to keep used products, components and materials in circulation.

Circular businesses engage internal stakeholders (employees) to tap into their expertise, resources and networks, and to foster support. And they engage externally across value chains and sectors to help build systems to repurpose or reprocess technological, mineral and biological elements.

Often, circular expertise exists beyond your walls. You may need to look outside to other businesses, suppliers, inventors, scientists, etc. to identify the skills, techniques and systems your business needs. Research on circular business models reveals that collaboration is essential.

## Range of stakeholders brings Enterra's product to market

[Enterra Feed Corporation](#), a Canadian company that has found an innovative solution to food waste, realized success through a partnership model, including collaboration with governments, universities, customers and suppliers. Enterra engaged with diverse partners in its start-up phase, including:

- The City of Vancouver to find a suitable site for a demonstration plant.
- Canada's National Research Council, which provided \$450,000 in financial support in its early years.
- Agriculture Canada and Kwantlen University to field test its natural fertilizer product.
- Skretting, the largest feed manufacturer for the aquaculture industry, to test its product on fish.

Refer to the Enterra Feed Corporation case study in [chapter 5](#) for further details.

## Prioritizing stakeholders

Depending on your business model, you will need to choose from a range of stakeholders in planning your engagement strategy: staff, suppliers, manufacturers, retailers, customers, processors and haulers, government, industry peers or competitors, researchers, investors, etc. Relationship-building with everyone in your value chain will be necessary over the long-term but prioritizing top stakeholders in the short-term will enhance impact and help you focus.

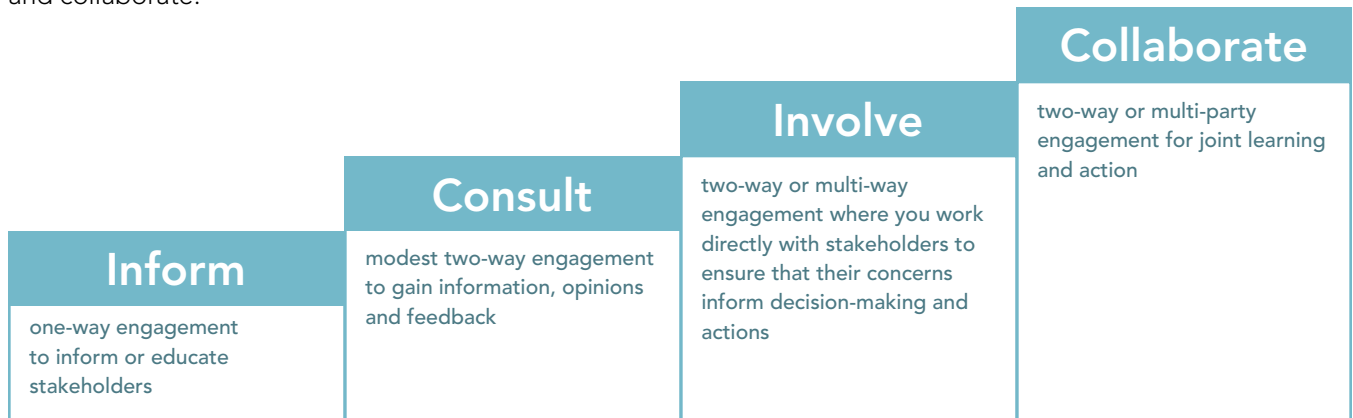
Using the five business models previously identified, here are some possible top stakeholders to engage.

BUSINESS MODEL	SAMPLE TOP EXTERNAL STAKEHOLDERS
Product as a Service	Suppliers and customers
Product Life Extension	Customers, suppliers, retailers and distributors
Circular Supply Chains	Suppliers
Recovery and Recycling	Recycling plants, regulators, landfill operators, haulers
Sharing Platforms	Users, insurers, governments

A value-chain analysis may reveal other stakeholders to bring your circular vision to life.

Developing a stakeholder engagement plan will help you clarify objectives and guide implementation – setting out the purpose of your engagement, articulating your pitch or call to action, and ensuring that the relationships you champion create value for all parties. Benefits have to accrue to everyone for the innovation to work.

The typical hierarchy of stakeholder engagement starts at inform, advances to consult, before moving to involve and collaborate.



The more you advance on this continuum, the more effort you need to invest but the greater the potential benefits. Your approach should be tailored to the scale and priorities of your business and initiative, with a focus on those stakeholders critical to your success.

As circular economy models disrupt conventional linear approaches your efforts may encounter resistance. Draw on change-management literature which advises companies to invest time in developing a powerful pitch, one that demonstrates to stakeholders the business case or rationale for their products and services.

Suggestions are offered below for engaging the top four stakeholder groups important to circular projects: employees, customers, suppliers and industry peers.

## Employee engagement

As your company adapts its current activities to a circular business model, employees in product development, marketing, logistics and procurement need to understand the motivations, goals and desired outcomes.

Measures to build internal support and participation include:

- Demonstrating the commitment and buy-in of senior management
- Building circularity into corporate strategy, policies, guidelines and procedures (e.g. procurement)
- Including circularity in job descriptions and reward and recognition systems
- Training employees in aspects of circular production
- Communicating regularly and highlighting circular success stories to employees

Internal communications will underpin your success. Employees need to know the “what, why and how” of your strategy and progress, throughout the transition.

## Customer engagement

Circular businesses often move from one-off customer transactions to ongoing and value-added customer relationships. Customer loyalty grows as you introduce ongoing service models, take-back programs and access over ownership solutions. Businesses can spend a lot of money acquiring new customers; so, good stewardship of customers at regular touchpoints is critical to ensure repeat business and generate opportunities to sell additional products and services.

Customer incentives for the return and reuse of products or components at the end of their primary use:

- Cash rebates
- Discounts on future purchases
- Convenient return of product at company locations
- Pre-paid shipping for returned products
- Turn-key packaging (ready for immediate reuse) and pick-up service
- Producer or distributor physically reclaims product
- Manufacturer commitment to refurbish product and return for continued use

Your sales and marketing staff will be important internal partners in your customer engagement effort. As well as generating demand and fulfilling customer requirements, they will now need to boost revenues from the use of products and services rather than the simple purchase of them.

Your sales and marketing teams will also need to figure out how to engage and incentivize customers to use and dispose of their products properly, especially if adopting service-based models where customers no longer have direct ownership of products.

After-sales service staff will need to sell spare parts and manage channel partners and become more active in managing the lifecycle of the product to maximize its retained value. Increasingly, sales and marketing will be driven by a keener understanding of the use-phase of products and services, to inform continuous improvement for circular use.

As you develop your customer engagement plan think about:

- Co-innovation, experimenting, testing and piloting with early adopter customers
- Market research identifying barriers, real and perceived, of potential consumers to inform decisions and communication strategies

- Building upon your customer’s values to link how circular practices align with their belief systems
- Adding product extensions and value-added benefits after initial launch
- Developing strategies to turn customers into suppliers in which they are incentivized to return materials back to your company

Continuous customer engagement will help create a receptive market for circular products and enhance your competitiveness.

## Supplier engagement

To advance your circular innovation you may need to co-innovate with suppliers. This calls for a more engaged and collaborative relationship with your supply chain. Your business model options, value chain analysis and design process will already have identified whom to approach.

In some cases, your approach may be to specify your circular requirements in your bidding documents; in others, a more engaged and collaborative style with your suppliers may be appropriate. Here is a continuum of supplier-engagement practices to help develop your approach:



### Walmart Educates Suppliers on Recycled Packaging Alternatives

In late 2019 Walmart released version 2.0 of its [Recycling Playbook](#) at its supplier Innovation Summit, attended by more than 350 suppliers, employees and innovators. The event was held to advance Walmart’s efforts towards recyclable packaging, recycled content, compostable materials and reusable models and delivery. Walmart developed the Recycling Playbook as a resource for suppliers to help them set recyclable packaging and recycled content goals. The document, which is organized by packaging format, focuses on the common packaging formats in Walmart stores. This is part of Walmart’s efforts to provide educational tools to suppliers to inspire their circular business models. The company collaborated with the Association of Plastic Recyclers and the Sustainable Packaging Coalition to create the Playbook.

There are many routes to supplier engagement. A possible first step is informing your main suppliers of your circular objectives. Subsequent steps include consulting them about your planned approach and providing information on how they can become a circular business themselves (see Walmart Text Box for an example of this approach).

Developing and sharing metrics—about waste diversion for example—can help communicate progress. You may also fund or support measures to build the circular expertise and capacity of suppliers, conduct joint research on potential innovations, provide financial or preferred supplier incentives, share the costs of your supplier's innovation or jointly pursue circular innovation to meet your shared goals.

As you roll out your venture consider whether material inputs for product designs are renewable or fully restorable, as well as their environmental footprint and toxicity. To maintain adequate volumes of inputs you might also need to reconfigure your supply chain from a few large-scale suppliers to many different small-scale suppliers.

Closing product loops might lead your company to think differently about how its supplier relationships work. For example, you might move to rental agreements with suppliers.

Expect an explosion of new supplier-relationships in the coming years as businesses transition to the circular economy.

## Energy Company Engages Suppliers to Foster Supply Chain Circularity

In 2018 the Italian energy company ENEL launched a project called the '[Circular Economy Initiative for ENEL Suppliers Engagement](#)' to improve the sustainability and circularity of its supply chain. The project, which involves 30 significant global suppliers, uses a web tool where suppliers are encouraged to insert their data to determine the circular economy index of their companies. The initial stage was to develop the circularity criteria for products and engage with suppliers to understand their level of circularity awareness. Two of the main challenges in the pilot stage were suppliers' reluctance about engagement and defining the circular economy. To overcome these, ENEL organized supplier workshops and presentations to provide an understanding of the benefits of using circular procurement. The company further defined its own circular model by developing specific key performance indicators, assessing key issues for each technology deployed by the company and introducing circular criteria as a key factor in its tenders.

ENEL's Global Procurement department also conducts research to achieve a detailed understanding of the flows of company materials, including components, environmental impact and recyclability of final products, such as wind turbines and photovoltaic modules. It is developing a system for analyzing the circularity of its supply chain and procurements. With this information, the company will be positioned to engage in further collaboration with its suppliers to foster their shared circular transition.



## Industry engagement

It may be desirable to engage with industry peers, even competitors, to realize your circular goals. This is something to consider and manage carefully owing to intellectual property or collusion risks; however, economies of scale are a powerful rationale for joining forces with industry partners.

### Industry engagement benefits

- Opportunities to co-fund research, while sharing or reducing risks and costs
- Opening up access to new expertise, competencies and perspectives
- Enabling logistic and infrastructure solutions for collection, transport, sorting, reuse and recycling
- Extending your reach and influence with customers, suppliers and governments
- Assisting with government outreach and standards development, and advocating generally for circular economy policy (e.g., to shape new regulations governing extended producer responsibility and product stewardship requirements)
- Fostering product and service innovation through cross-fertilization and joint venturing

A general process for industry collaboration includes: bringing parties together, creating mutual understanding, finding common ground, undertaking R&D to define and analyze risks and opportunities, defining the vision of a circular sector, setting baselines, goals and targets, and implementing and refining plans. Options include collaborating with sustainability leaders in your industry locally for local initiatives, or nationally for national projects; collaborating through your industry association, or – for small business – working with a chamber of commerce or board of trade on collaborative circular projects.

### Industry engagement success factors

- Contacts at the collaborating companies are empowered to make decisions and marshal resources
- Collaborative ventures do not breach rules or codes of competition
- Participating companies are committed, with common goals and objectives
- Transparent information exchange
- Clear, agreed-upon list of deliverables with long term system-wide goals alongside short-term quick wins



## Canadian Industry Association promotes Zero Plastics to its Members and Other Industries

In mid-2019, [Canada's Food, Beverage and Consumer Goods Manufacturers](#) association endorsed a zero plastic waste ambition, becoming the first Canadian trade association to do so. Through the New Plastics Global Economy global commitment, member companies can commit to specific targets to achieve the vision, including making all packaging 100% reusable, recyclable or compostable by 2025. The association is encouraging member companies to sign the global commitment and encouraging other Canadian industry associations to endorse the commitment.

## Co-location and Materials Exchange

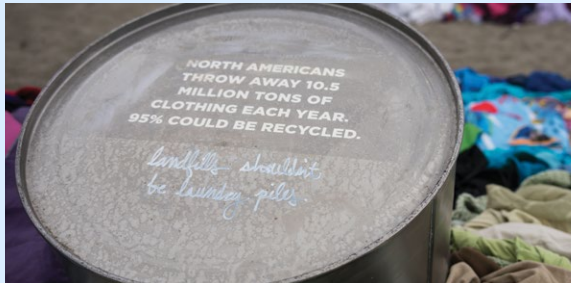
Co-located businesses can be a driver of circular innovation – enabling businesses to overcome challenges through place-based collaboration. Sometimes called industrial symbiosis or industrial ecology, opportunities exist to establish relationships between two or more businesses in which the materials, energy, water or by-products of one business become the raw materials for another. Tire-shred, plastic pellets or waste steam from a factory are examples of outputs that can be sold to other businesses. This can also extend to the shared use of assets, logistics and expertise.

Co-location and material exchanges can help companies:

- Reduce raw material and waste disposal costs
- Earn new revenue from residues and by-products
- Divert waste from landfill and reduce carbon emissions
- Open up new business opportunities

## Industrial Symbiosis

Industrial symbiosis is based on a re-thinking of “waste”, in which unused outputs from one organization is used as an input to another business. The resulting benefits include reduced waste, improved resource efficiency, less material sent to landfill, and fewer greenhouse gases (GHGs) and air pollutants. This transfer [is not limited to materials](#), it can include resources such as energy, wastewater, transportation, asset utilization and expertise. [Examples of industrial symbiosis](#) range from the use of waste heat from one industry to warm greenhouses for food production to the recovery of car tires for use in construction materials.



## Materials Exchanges Take Off in Canada

### Toronto Materials Exchange Program:

Material Exchange facilitates the transfer of surplus materials between businesses and non-profit organizations to divert waste from landfill and support local communities. The program contributes to a circular economy by:

- facilitating local exchanges to keep materials in circulation longer;
- preventing businesses from having to dispose of surplus material, which can reduce their waste management costs; and
- providing community groups with free materials that are of value to them.

The program is offered through Partners In Project Green, a partnership between the Greater Toronto Airports Authority and is delivered through collaboration with businesses, recyclers, community groups and non-profit organizations that can accept and reuse the excess materials generated within the Greater Toronto Area. By 2019 the following results were achieved:

- 40 non-profits are members of the Material Exchange network
- 142 exchanges of material facilitated
- 723 tonnes of materials diverted from landfill
- \$625,000 dollars worth of materials exchanged

## Resources for Stakeholder Engagement

[Public Procurement for a Circular Economy: Good Practice and Guidance](#), European Union 2017

[The Transformational Company Guide](#), Quality #13 – Stakeholder Accountability and Transparency. Canadian Business for Social Responsibility, 2015. Brief on why and how to engage stakeholders.

[The Transformational Company Guide](#), Quality #15 – Industry Standards. Canadian Business for Social Responsibility, 2015. Brief on why and how to collaborate with industry partners, with examples.



## CASE STUDIES

This section will provide relevant examples of the concepts that have been presented. The following companies are profiled:

- BMW Share Now
- Enterra Feed Corporation
- Enviro Image Solutions
- FROGBOX
- Philips Light as a Service
- Toronto Tool Library



## BMW Share Now

### General Information

- 14 countries, 26 cities
- Automotive sector
- Joint venture between BMW Group and Daimler AG
- [www.share-now.com](http://www.share-now.com)

BMW Group, the German luxury car company, launched a car-sharing mobility service DriveNow in Germany in 2011 in a joint venture with Sixt, a car rental agency. Originally each company held a 50% share of the joint venture. BMW Group contributed the vehicles and the automotive technology to the joint company. Sixt provided the services, the car rental know-how, the IT systems, and an extensive network of stations for customer registration. By 2017 DriveNow operated over 6,000 vehicles in nine European countries. That year the company reached the milestone of one million customers.

The following year DriveNow became a wholly owned subsidiary of BMW in 2018. Then in 2019 DriveNow and car2go, a carsharing service provided by Daimler AG, merged to form the global mobility provider Share Now with a combined fleet of over 20,000 vehicles (over 3,000 of which are electric) in 26 cities in 14 EU and NA countries and over four million members.

Share Now is one of five mobility services which are part of a mobility joint venture of the BMG Group and Daimler AG. Both automakers plan to invest over \$1 billion to scale urban mobility services over the coming years. The services include: Share Now, plus Free Now, a ride-hailing company; Charge Now, a network of public charge points for electric cars; Park Now, parking services; and Reach Now which offers multi-modal trip planning services.

BMW's views of the future of car ownership influenced its original decision to enter the car-sharing business. DriveNow estimated that an average car was used only about 4% of the time and with half the global population predicted to live in cities by 2050 and parking becoming ever more difficult, urban residents were increasingly looking for alternatives to ownership.

Observing that in cities that embraced car-sharing a single such vehicle had the potential to replace dozens of cars, the company determined in the early 2000s that it needed to be in the car-sharing sector. It also allowed BMW to access customers it normally had trouble reaching, as the average age of the company's buyer was in their mid-40s while the average age of a car sharing user was 32. Younger generations are not as attached to car ownership and continue to make multi-modal choices in transportation.

Even more recently, BMW has reimagined its role in the automotive sector from one of selling cars to one of mobility services.

Now, according to its Board Chair: "We have a clear vision: these five services will merge ever more closely to form a single mobility service portfolio with an all-electric, self-driving fleet of vehicles that charge and park autonomously and interconnect with the other modes of transport. This service portfolio will be a key cornerstone in our strategy as a mobility provider."

## References

[BMW Group and Daimler AG invest more than €1 billion in joint mobility services provider](#)

[Share Now](#)

# Enterra Feed Corporation

## General Information

- Private company founded in 2007
- Agriculture sector
- Head office in Maple Ridge, BC; production facilities in Alberta
- 40 employees
- [www.enterrafeed.com](http://www.enterrafeed.com)

Founded on a disruptive vision to transform the aquaculture and organics disposal industries, Enterra diverts recycled food products and converts them into ingredients for animal food production. Rising global demand for fish and poultry is placing increased pressure on food inputs and costs. At the same time, over 30% of the world's food supply is sent to disposal or composting with considerable loss of complex food nutrients. Enterra Feed Corporation addresses both issues by up-cycling waste food to grow sustainable protein, oil and natural fertilizer products for use in animal food production.

Enterra uses larvae of a local beneficial insect, the black soldier fly, to up-cycle complex nutrients from pre-consumer food discards. After consuming the waste food (feedstock), primarily fruit and vegetable discards, the larvae are harvested and processed into ingredients for fish, livestock and pet feed which substitutes for costly and resource-intensive ingredients, such as fishmeal, poultry meal and soybean meal. Enterra's natural process also creates an organic fertilizer that can replace chemical fertilizers. The company is now in large-scale commercial production and has moved to a 180,000 square foot facility in Balzac, just north of Calgary, Alberta.

## Resource Recovery

The recovery of useful resources and value at the end of one product lifecycle feeds into another, transforming waste into value through innovative recycling and upcycling. Solutions include industrial symbiosis, integrated closed-loop recycling to Cradle-to-Cradle designs where disposed products can be reprocessed into new products.

## Business Development

Since 2009, Enterra's scientists have successfully developed and tested hatchery modules which provide a fully controlled, artificial environment optimized for the life cycle of this beneficial, non-invasive insect. In a few years, the scientific team found a way to domesticate a natural process – mimicking nature's way of up-cycling waste organics. Enterra was the first company in the world to develop technology at a commercial scale that up-cycles fruits and vegetables to produce animal protein and oil. Many animals don't eat fruit and vegetables but readily eat insect larvae.

At full capacity, Enterra anticipates it will process 170 tonnes per day of feedstock, which produces approximately 7 tonnes per day of protein and oil feed ingredients and 12 tonnes per day of organic natural fertilizer. Enterra's technology results in approximately double the utilization of the food nutrients compared to anaerobic digestion (waste-to-energy).

While preventing waste food or donating unused food to food banks are preferred strategies, the waste food inputs used in Enterra's processes are not approved for human consumption, making insect feedstock the highest value, most efficient conversion of the nutrients in waste food.



## Partners and Collaborators

Enterra benefited from a number of government, academic and business partnerships during its start-up and testing phase:

- Worked closely with the City of Vancouver to find a suitable site for the demonstration plant.
- Metro Vancouver provided information, advice and technical assistance in acceptable organics diversion practices.
- National Research Council's Industrial Research Assistance Program (federal government program) were early stage partners providing \$450,000 in financial support over 2009 to 2013, a critical investment which offset some of the high-risk costs such as early-stage hiring, without which Enterra might not have launched
- Agriculture Canada and Kwantlen University helped to test the natural fertilizer product in field trials
- Skretting, the world's largest feed manufacturer for the aquaculture industry and interested in future opportunities to include insect protein as part of their product offerings, helped Enterra test their product with fish in field trials
- Taplow Feeds was also interested in the market growth potential of insect proteins and provided advice during the trial period.

## Social and Environmental Impact

Waste diversion and resource recovery

- In 2020, Enterra estimates that it diverted 50,000 tonnes of organics to its facility, capturing the valuable food nutrients.

Greenhouse gas emission reductions

- An assessment of GHG emissions, the results of which were not yet available at the time of the launch of this publication, was carried out in 2020. Enterra expects that it will have a lower GHG impact compared to composting or landfill due to the company's minimal machinery requirements, lack of methane production, full diversion of organics and the use of its sustainable products in local food production.

Water conservation

- Enterra does not add any water to grow its "livestock". In fact, the majority of the moisture in the diet is naturally derived from the feedstock that is used. (For comparison, to grow 1 pound of beef takes about 1,400 gallons of water.)

Social benefits

- At current capacity the company has created 40 new jobs all of which are paid well above the minimum wage.

## Success

Enterra finds both advantages and disadvantages as a first mover in insect proteins as animal feed. As a path finder it must solve various problems such as market acceptance, regulatory barriers and feedstock diversion. However, as a frontier company it is attracting investment interest and customers who are looking for ingredients that allow them to differentiate their products. Enterra has also benefited from a positive provincial and local government reception, given government's interest in green economy solutions. Enterra attributes its success primarily to its customers and investors who have embraced this circular economy innovation and fueled its growth.



# Enviro Image Solutions

## General Information

- Print service industry
- Based in Vancouver, BC and commenced operation in 2007
- Client base: commercial printers located in North America, Europe, Japan and China
- Annual gross revenues >\$10,000,000
- 15 employees
- [www.enviroimagesolutions.com](http://www.enviroimagesolutions.com)

The commercial printing industry has undergone many significant technological changes over the past decade to improve efficiency, reduce costs and produce ever higher quality images. However, one of the most significant cost and waste drivers that remained unaddressed was the use of printing blankets, which are a critical part of the printing process. (see below)

## What Is A Printing Blanket?

The next time you open a newspaper or magazine, or sit down to read a book, there is a fair chance that the ink on the pages has been put there by a printing blanket. Most print – such as newspapers, books, leaflets and packaging materials – is produced using a traditional offset press. Although these machines vary enormously in size and complexity, and can cost up to millions of dollars, they all rely on a process in which the ink is transferred – or offset – from a printing plate to a printing blanket (a polymer-coated composite fabric, wrapped around a cylinder on the press) and then from the printing blanket to the paper. The final image quality depends entirely on an accurate transfer of ink, often at very high speeds and on to a variety of different types of paper.

Printers can replace the blankets as often as each printing job and typically discard their used blankets into landfills. Each printing press generally produces more than one tonne of printing blanket waste every year. To address this costly and wasteful process, Enviro Image Solutions (EIS) pioneered their proprietary Blanket Renewal Technology, which renews and recycles used printing blankets. The service helps printers convert their printing blankets from one-time use consumables into multi-use assets, extending the life of their printing blankets by as much as 400% without compromising quality.

By using the printing blanket service, printing companies save tens or even hundreds of thousands of dollars, reduce overall printing blanket usage, improve press room efficiency, keep presses maintenance free for longer and eliminate tonnes of printing blanket waste from landfills. The company's circular economy innovation shifts the focus from a single use design to design for many life cycles, extending the life of the product.

With its innovative Blanket Renewal Program, EIS also has re- conceptualized the printing blanket, from a one-use product to a "product as service", with built-in incentives for product longevity and reusability.

## Product Life Extension

Extend working lifecycle of products and components by repairing, upgrading and reselling.



## Start-Up

In 2003, a group of printing industry professionals, engineers and chemists created a research and development team to develop a blanket renewal process. A high-end printing plant hosted the trial and error testing of the developing technology.

After four years of beta testing, refining processes and significant funding, the team developed the world's first and only Blanket Renewal Program. EIS uses its proprietary multi-step processes to restore the printing characteristics of the used blankets to as good as new. The resulting specialized technology was developed and ready for commercial production in 2007.

In 2007, the Printing Industries of America and the Graphic Arts Technical Foundation awarded the company its coveted Intertech Technology Award. The year following EIS received two top awards at the Print Action 2008 Environmental Printing Awards.

## How It Works

Once a printer determines that a blanket can no longer be used it is crated and sent to EIS for treatment with proprietary processes that restore it to full quality. EIS then ships the press-ready renewed blankets back to the plant. If handled properly each blanket can be renewed between four and ten times (the average is four) as long as the top layer of a blanket is uncut. The printer retains ownership of the blanket throughout this process.

EIS provides an additional value-added service that helps to further extend the life of the printing blanket. It is the only company in the world that studies blankets after they have been used on press, multiple times. EIS analyzes the unique physical damages on the blankets to identify issues that reduce blanket life and negatively impact production efficiency. They then make custom recommendations to the pressroom to

prevent the physical damage from recurring on the press. On average over 30% of the blankets have issues that are entirely preventable. Accordingly, EIS' service not only reduces the direct cost of blankets through its renewal technology but also reduces the total volume of blankets used by the printer as new and renewed blankets last longer on press with fewer change outs, resulting in a more efficient production process for its customers.

Once the printer understands these benefits, they routinely ask for additional products and services available from EIS.

Accordingly, the opportunity to cross-sell other products or services using the blanket renewal platform is significant. This front-line customer communication creates a trust that allows for the introduction of new products or services that could complement the existing system, such as inks, washes, premium blankets, or complete blanket-ink-washes packages, etc. The company's goal is to manage the entire consumable supply chain, deliver a superior sustainable and money saving package, and lock in the customer relationship.

Since its first customer in 2007, the company has adapted its technology to address other printing methods, such as web and sheet fed. Its services are now available for all types of printing press.

The company is committed to sending zero waste to landfill. Thus, it also designed a Blanket Recycling Program for spent blankets. Once a blanket can no longer be renewed, the aluminum or steel bars are cut off, and the rubber and fabric materials are chopped into small pieces for use in other processes. For example, EIS upcycles printing blanket waste into wallets, belts, iPad sleeves and other products, capturing the residual value of the blanket at the end of its useful life. The remaining waste is used for clean burning fuel. The residual ash from combustion

is combined with mineral waste streams and other raw materials in the manufacture of Portland cement, keeping the blanket program landfill free. This further eliminates the consequential GHG emissions during the degradation of the rubber biomass from the printing blankets in the landfills. Finally, each time one blanket is renewed, the carbon emission from the manufacturing of one new blanket is eliminated.

### Customer Reception

EIS can serve customers anywhere in the world and to date has clients in North America, UK, Japan and China.

Customers are attracted to the lower price point of the renewed blankets which also compliments suitability and continuous improvement initiatives. EIS' ability to reduce blanket costs by up to 60% from its competitors who offer single use blanket sales, has resulted in considerable growth since its launch in 2007. High customer satisfaction has assured repeat and consistent business.

To attract customers and overcome the initial barriers, the company offers a free trial of its technology. Online videos of satisfied customers realizing thousands of dollars in cost- savings address many of the concerns printers face when considering the new technology.

Customers save up to 60% of the cost of new blankets. Larger printing facilities with multiple presses have saved more than \$300,000 and eliminated in excess of 25,000lbs of printing blanket waste from landfills per year by subscribing to the Blanket Renewal Program. Medium sized printers with a handful of presses generally save between \$100,000 to \$200,000 and 10,000lbs to 20,000lbs each year. In addition to reductions in these consumable and landfill disposal costs, the program increases press room production efficiencies.

### Printing Company Incubates Circular Economy Innovation

Metropolitan Fine Printers (Met), Vancouver's largest printing company, is the original circular printing innovator. In 2007, it was the originator of the printing blanket service, driven by costs and waste from a technology conversion.

In the early 2000's Met upgraded its printers to UV technology, a form of digital printing that uses ultra-violet lights to dry or cure ink as it is printed. This generated a significant increase in printing blanket cost and waste, with blanket costs skyrocketing from \$3,000 to \$55,000 a month including landfill costs. For three years engineers, printers and technicians experimented with ways to reuse the blankets and extend their useful life originally testing with Met and then beta-testing with other first-mover customers. Once the product was commercially successful, in 2011, Met's owners, a family business, created an independent spin-off company, Enviro Image Solutions, to market and sell the product globally. Now, each time the printing technology changes, the two companies collaborate on refinements, to make sure they can provide a quality printing blanket service option for the global market.

EIS is now established as Met's innovation arm, and a critical partner in Met's circular business ecosystem.

# FROGBOX

## General Information

- Founded in 2008
- Serves 40 cities
- Moving and storage
- [www.frogbox.com](http://www.frogbox.com)

FROGBOX is a Vancouver-based moving supply franchise company founded in 2008 with a mission “to minimize the stress of moving on our customers and the Earth”. FROGBOX provides residential and commercial clients a convenient, affordable and eco-friendly alternative to cardboard moving boxes: stackable, industrial strength, water resistant plastic boxes that are delivered and picked up.

The moving box rental service is a time-saver: it eliminates time spent picking up, assembling and disassembling single-use packing material. After unpacking the boxes can be nested in stacks until pick up, taking up a minimum amount of space. They have handles for easier carrying, stack perfectly, don't collapse or slide, and protect valuables. To secure important content, the lids can be locked with zip-ties or padlocks.



Reusable wardrobes for moving clothes and recycled packing paper are also available.

Each FROGBOX plastic moving box is re-used 400 times before being fully recycled. Because reuse takes less energy than recycling, the FROGBOX has a lower carbon footprint than cardboard boxes which are typically recycled after less than two uses on average. The boxes are made of easy to recycle High Density Poly Ethylene (HDPE), #2 plastic. Cardboard and paper waste make up an estimated 18% to 26% of landfill material and FROGBOX helps eliminate that potential impact of moving.

To come up with their original business idea, the two founders spent 2007 brainstorming different options, based on companies they admired. They wanted to create a company that offered outstanding customer service, addressed an environmental issue, and solved a customer problem.

The idea for their business came from a recent personal experience. One of the founders had just moved to Vancouver from Ohio and had been charged hundreds of dollars for cardboard boxes that soon became water damaged in their garage. Through market research the founders concluded the moving industry had a bad reputation, making it a perfect sector in which to apply outstanding customer service.

Plus, the industry hadn't seen much innovation in years, so offering an environmental alternative to cardboard boxes such as cost-competitive plastic box rentals would be a practical innovation.

Since 2009, the company has been measuring and reducing its carbon emissions, achieving a 25% reduction in emissions per box delivered towards a longer-term target of 35%. Where available FROGBOX operates its trucks on biodiesel made from waste streams from industrial processes. To reduce emissions and costs, the business optimizes its routing systems, uses a paperless invoicing route planning system and maintains an extensive recycling and composting system at head office.

## Product as a Service

An alternative to “buy and own” this model promotes access over ownership, which is retained by the company. This internalizes benefits of circular resource activity by shifting incentives for product durability and upgradeability from volume to performance based.

The company’s growth was considerably enhanced in early 2011 when it was featured on Dragons’ Den, the reality TV show for entrepreneurs. This attracted two investments of \$200,000 and the resources needed to expand across Canada. As a result of the publicity from Dragons’ Den, the company received over 1,500 franchise applications. It now has 19 locations in Canada (18 of them franchised) and three in the U.S.

Since the company started in 2008, it has rented over 2.5 million moving boxes. By eliminating 2.5 million cardboard boxes, they’ve helped save time and reduce waste:

- 2603 days’ worth of time saved not assembling boxes.
- Enough tape to go to the moon and back 20 times.
- Enough cardboard to fill 163 airliners (747’s).

Frogbox has become a leader in the moving industry by referring thousands of its customers to vetted, trustworthy, moving companies.

FROGBOX donates 1% of gross revenues to frog habitat restoration via membership in 1% For the Planet. Frogs are the most threatened vertebrate group on Earth, with nearly one- third of the world’s 6,468 amphibian species in danger.

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## Philips Light as a Service

### General Information

- Founded in 1891 in Eindhoven, Netherlands
- Consumer products sector
- 70% of revenue from business-to-business sales
- over €21 billion in annual sales globally

Philips, the Dutch lighting, healthcare and consumer lifestyle company and the world's largest lighting supplier, began its sustainability journey in the early 1990s when it set its first sustainability standards. It began by focusing on technology innovations to reduce packaging and increase the energy efficiency of its products. This focus shifted over time to consider end-to-end solutions and how the company could influence consumer choices and behaviour. This resulted in a growing portfolio of green product developments.

By 2015, about one-third of its over \$2B annual R&D budget was directed towards green innovation. Today the company's mission is to make the world healthier and more sustainable through innovation and its goal is to improve the lives of 3 billion people a year by 2025. It committed to this mission in 2012 both as a competitive necessity and with the conviction that companies solving the problem of resource constraints will have an advantage. It believes that customers will increasingly consider natural resources in their buying decisions and will give preference to companies that show responsible behaviour.

It was spurred to pursue a circular economy business model by a pioneering company in its home market. In 2009 Rau Architects, an architectural agency specializing in sustainable building design, approached the company to upgrade its lighting at its Amsterdam

office. It told Philips it only wanted to buy light, but not the expensive infrastructure (lamps, luminaires, cables and controls) it would eventually need to replace and dispose of. Rau Architects wanted the exact amount of light for workspaces and rooms that employees needed but nothing more. Rau Architects, Philips and an installation partner, CasSombroek, began a co-creation process to design a bespoke, intelligent lighting system maximizing natural sunlight, adapting LED light fittings to the building and installing a motion/daylight sensor and controller system. (It proved to be an extremely interesting experiment in – and proof-point of – how little artificial light an office actually needs.) Since 2010 Rau Architects only pays for the actual amount of light (lux) consumed, not the equipment or the raw materials used in the products.

### Product as a Service

An alternative to “buy and own” this model promotes access over ownership, which is retained by the company. This internalizes benefits of circular resource activity by shifting incentives for product durability and upgradeability from volume to performance based.

By moving from a one-time sale to a ‘pay per lux’ model Philips maintained ownership of the materials while Rau paid for maintenance and service with the option to adapt or upgrade the setup. From the start, the installation of this LED lamp system saved 35% energy. In the next phase, Philips implemented smart energy meters which gave further insight into the energy consumption per space. This monitoring and optimization process saved another 20%, amounting to a 55% energy saving in total.

As a result of this innovation, Philips further studied its lighting proposition, from the social benefits of light and the implications for health and wellbeing, to how materials are recycled and reused, the opportunities for leasing as opposed to selling materials, using renewables and incentivizing business partners to increase their efficiency. The company developed a commercially successful business model with significant environmental and financial benefits for customers.

Managed lighting services extend the lifetime and performance of the products. This allows the customer to take full advantage of the newest lighting solutions, increase energy efficiency and reduce operational costs. Philips pays the upfront costs of installation and is compensated through a performance contract – the energy savings the retrofit produces. Exploring possibilities from a second-hand market enabled Philips to capture new value from used parts and luminaires and further co-creation with like-minded companies creates a platform for innovation.

And, at the end of the service period, lighting products can be returned to the production process again and get a new life in the refurbish, parts harvesting or recycle loop.

Inspired by a conversation with Ellen MacArthur, founder of the Ellen MacArthur Foundation (a non-profit dedicated to promoting progress towards a more circular economy), the CEO became convinced that adopting a circular economy business model was the next logistical step for Philips. The company studied its place and role in the supply chain, what kind of change would be required and what types of products and services could be redesigned with circular economy principles. Realizing it needed new skill sets and new relationships with recyclers, retailers, consumers, resource providers and regulators, Philips initiated a partnership with the Ellen MacArthur Foundation. The Foundation provided the company support in the

design of collaboration models, training materials for employees and access to a peer network including BT, Cisco and others.

In its “Design for Excellence” innovation process, the company added circular economy criteria to its original criteria of recyclability, upgradability and serviceability. To help accelerate the transformation to circular principles the company created a center of expertise—a permanent internal group that helped with methodologies and programs. The center was networked through the entire organization and involved every business unit. Philips management believed the circular economy needed to be intrinsic in the company’s end-to-end value chain and embedded in all its strategies, processes, metrics, and structures.

With this repositioning established, Philips began spinning off its lighting division to a new company called Signify, while transitioning to become a medical equipment company. Signify continues to offer “outcomes-based lighting performance” to customers, pioneered by Philips. Customers are offered:

- Lighting design based on the lumen output, not a selection of products (pay only for the light you use rather than purchasing your own lighting equipment);
- Money savings on energy, maintenance and depreciation costs (no capital expenditures, maintenance or replacement costs);
- Hassle-free operation of lighting and product upgrades;
- Package includes future technology updates;
- Luminaires are designed for reuse and recycling;
- Ability to minimize the carbon footprint and materials waste from lighting



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# Toronto Tool Library

## General Information

- Social enterprise founded in 2013
- Consumer goods sector
- Located in Toronto, Ontario and serves Toronto neighbourhoods
- Annual gross revenues are \$125,000; 3 part-time employees
- [www.torontotoollibrary.com](http://www.torontotoollibrary.com)

Founded on a disruptive vision to transform consumption in society, the Toronto Tool Library is a non-profit social enterprise that lends specialized tools to community members. The Tool Library's members borrow tools in the same way they would borrow a library book. The Tool Library has over 11,000 tools available for loan including home repair, construction and renovation, gardening and landscaping, and bicycle repair tools. The tools range from simple screw drivers and drills, to table saws, welding equipment, power generators. Four 3-D printers and a laser cutter are available for use onsite. It took less than a year for the Tool Library to move from an idea to its grand opening.

The library is a money- and space-saving alternative to ownership. Tool sharing reduces consumption and waste. The philosophy of the library – and what sets it apart as a social enterprise – is that it is not trying to maximize profit but trying to maximize membership and access. Library organizers continue to experiment with sharing economy business models promoting access over ownership and repair over recycling while fostering community and local relationships.

## Start-Up

The Tool Library's two founders joined forces in 2012 to create a non-profit organization called the Institute for a Resource Based Economy (IRBE), to provide education, engagement and tools to enable the transition to an ecologically and economically sustainable world. They began with a vision to develop a project that was disruptive in a constructive way - something that encouraged sharing but also challenged the way people think about resources. They decided on a tool library and established Toronto's first tool sharing service which they structured as a non-profit social enterprise within the Institute.

## Sharing Platforms

Enable increased utilization rate of products by making possible shared use/access/ ownership.

In early 2013, they posted a call for tool and financial donations on the internet and through the local media. The request went viral and the Library received over 1,000 tools. Subsequently, the library was able to build its inventory primarily through donations. The donated tools not only created a community asset but put unused goods back in circulation and kept them out of the landfill. The Tool Library secured space for their first location in the basement of a recreation centre. About 100 volunteers participated in the initial renovations to convert a basement storage space into a community hub for sharing tools. For inventory and membership management they used MyTurn's tool lending library software which was available for free.

Six months after the Toronto Tool Library opened, it expanded into a second, larger location. One night of fund-raising generated \$5,000 in local community donations. The positive community reaction provided the confidence the Library needed to more than triple

its capacity and expand its services in one year. Today it has three locations, one of which includes its popular “maker space” where members can work on their projects with library tools. It has not been easy to find a location to operate both a tool library and maker space, because these combined operations fall in the gray zone between retail/commercial and industrial definitions.

In its early years, the Tool Library received funding and support from:

- Ontario Trillium Foundation (for a 3-D printer, laser cutter and youth programming)
- Home Depot Canada Foundation (the foundation contacted the Tool Library with an offer of a grant)
- Canadian Tire and The Mibro Group (tool donations)
- Social enterprise 5-year cash flow loan from Alterna Credit Union
- Community and crowd-funded donations
- Membership revenues

Volunteers staffed the library during the launch and start-up year, keeping its costs low. Volunteers continue to play key roles as librarians, shop supervisors and maintenance and repair volunteers.

Today the library operates on a break-even basis. While grant funding played a significant role in the early years, memberships and programming are now the sole revenue sources. Memberships start at \$55 a month and are subsidized for those who cannot pay the full cost.

Since its opening, the Tool Library has added to its service offering. The “maker space” offers tool and skills training and full-time workshop access for a maker membership fee of \$77 per month. Artists, hobbyists, professionals and others use the space for carpentry and woodworking, ceramics, product design, technology and robotics, maintenance and repair, construction, 3D printing and laser cutting. The library also offers skills training workshops, after school programs, 3D printing, laser cutting, and router services. The Tool Library vision is to be a community space where people can request or teach workshops: a space where everyone is constantly learning from each other.

Structurally, the Tool Library and Maker Space are organized separately. As the Tool Library didn’t meet the federal government’s charity definition, it has been structured as a non-profit. The Maker Space does, however, and runs as a charitable organization due to its educational nature. It can attract donations and charitable grants to offset its operational expenses. Its annual revenues are \$100K.

The Tool Library is committed to operate as a circular economy enterprise by eliminating its own operational waste impacts. For example, broken or defunct tools are taken to waste recycling facilities and parts are salvaged from broken items to repair other tools.

## Growth and Development

The Tool Library's growth model is built on three foundations:

(a) teaching the public how to use its tools and providing maker space; (b) expanding public awareness of, and access to, the Tool Library; and (c) increasing public acceptance of borrowing, repairing or sharing rather than buying and owning.

The Tool Library has incubated other circular economy sharing services, from a repair café to swapping. These helped foster public acceptance of the sharing concept.

The Repair Café operates weekly events in which people bring and repair their broken appliances. The Tool Library provides free space while repair volunteers help build the community of repairers in Toronto. It has inspired a local film maker to produce [Fixed!](#), a video about the repair experience. By repairing rather than discarding broken appliances, participants extend the life of their goods, reduce further consumption and landfill waste and save money.

Swapping: To further reduce consumption and waste, and promote its sharing philosophy, the Tool Library runs swapping events three times a year, in the spring, fall and at Christmas. At these events people bring and swap lightly used or new items considered usable and giftable. By inspiring swapping, organizers hope to shift the public norm from buying to swapping.

In its quest to accelerate the sharing economy, the Tool Library launched Canada's first "Library of Things" in 2016: The Sharing Depot. The depot offers a lending inventory of thousands of items including camping and sports equipment, house party supplies, board games and toys for \$55/year memberships.

## Impact

The Tool Library has 11,000 tools available for loan. Over 1,400 members have made over 115,000 successful loans, with close to a 100% return rate. This amounts to approximately 300 loans per week across three branches. Members are primarily younger men and women (about 50/50 split) between the ages of 25-35 mostly in the low to middle income bracket, living within about 5 – 10 kilometers.

"If you take out a drill once you save money with your membership. I estimate that well over \$100,000 has been saved by our users who would have had to buy their own tools instead of borrowing."  
– Ryan Dymont, Co-Founder

The Tool Library believes it is fostering community resilience by providing the resources, skills, networks and gathering places for neighbours to meet, learn, share and build their lives together. Jobs and volunteer opportunities are created, waste is reduced, consumption is lowered and the need for housing space and storage is reduced. People can save space and money and reduce the mining, refining, welding, shipping, and packaging that goes into making those underused tools in the first place.

Tool libraries operate across Canada – such as Vancouver, Calgary and Halifax – and around the world. They are part of a much larger movement where companies and individuals are maximizing the value of underutilized assets through different business models. While still in its infancy, the sharing economy has the potential to disrupt the way we produce and consume with long-run benefits for business and society.

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