



SCALING CIRCULAR FOOD SYSTEMS IN CANADA

STAKEHOLDER WORKSHOP

DISCUSSION PAPER

April 2022

Acknowledgements

This Discussion Paper was developed by The Delphi Group to support a virtual stakeholder workshop on scaling circular food systems in Canada that is being hosted on **April 28, 2022**, as part of the Circular Food Systems Work Stream. Supporting partners for the April workshop are listed below.

This Discussion Paper draws on information and insights sourced from an initial landscape scan of circular food solutions in Canada (see Feature Report sidebar), produced by the National Zero Waste Council (NZWC) and Guelph-Wellington's Our Food Future in October 2021, with research led by Sustainable Prosperity Institute. The report was co-sponsored by the Next Generation Manufacturing (NGen) Supercluster.

That initial assessment was supplemented by additional information sourced from a variety of other recent, relevant publications.

FEATURE REPORT: Circular Food Solutions in Canada – A Coast to Coast Landscape Scan

The *Circular Food Solutions in Canada Report*, developed as a foundational piece to inform the Circular Food Systems Work Stream, provides a first-of-its-kind study compiling and presenting examples of circular food solutions from across Canada.

The report profiles nearly 200 examples of circular food initiatives based in communities small and large from across the country, including a preliminary analysis of the key challenges and their enabling factors for success.

Work Stream Supporting Partners



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1. Introduction & Background

The food system is a critical part of Canada's economy while serving a key role in the supply of healthy and nutritious food and related products to domestic and global consumers. The food system is also woven into the social fabric of communities across Canada, with food providing an important cultural identity for many.

A Broken, Linear Food System

Globally, roughly a third of all food (equal to 1.3 billion tonnes annually) is lost or wasted at an annual value of nearly U.S. \$1 trillion.¹ Canada's current 'linear' food system has an enormous environmental impact, with a footprint that consumes large amounts of resources, land, and water, and generates enormous amounts of waste and global warming greenhouse gas emissions (GHG).

In addition, while Canada is one of the world's largest exporters of food products, more than four million Canadians (i.e., 10% of the total population) are food insecure – not including some of the highest at risk groups: people living on First Nations reserves, people in remote northern areas, and people who are homeless.² For example, nearly 70% of Nunavut lives in food insecurity. Similarly, household food insecurity rates of 70% have been documented in northern Ontario.³

The issue of food security is exacerbated by a lack of resilience in Canada's current linear food system that is vulnerable to supply chain shocks and disruptions – as demonstrated during the COVID-19 pandemic and recent extreme weather events across Canada.

How can we design our food systems and supply chains with circularity in mind in order to enhance productivity and spur innovation, capture lost value, reduce food insecurity while improving resiliency, eliminate waste and pollution, and regenerate nature and restore damaged soil and ecosystems?

A circular food system is designed to be more resilient through a diversity of low-carbon, regenerative practices, and localized food system loops that also help to reduce food insecurity.

“The circular economy model presents a vision for meeting the needs of an increasingly populous and wealthy global society within the safe boundaries of key ecological systems and processes.”

Source: A Circular Agriculture and Agri-food Economy for Canada⁴

About this Discussion Paper

This Discussion Paper is designed to stimulate dialogue and engage a broad set of stakeholders across Canada's food ecosystem as part of the Circular Food Systems workshop and set up for a 'playbook' of action going forward. It brings together information and insights from previous research, including the first-of-its-kind *Coast to Coast Circular Food Solutions Landscape Scan*⁵ and many others. Links and references have been included throughout for readers that wish to go deeper on the information.

¹ National Geographic (March 2020). Article entitled “The End of Trash”, p.61.

² Smart Prosperity Institutes December 2021 Report: “A Circular Agriculture and Agri-food Economy for Canada”.

³ Food Secure Canada (n.d.) “Affordable Food in the North” Food Secure Canada.

⁴ Smart Prosperity Institute (2021). A Circular Agriculture and Agri-food Economy for Canada.

⁵ Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

2. Circular Food Systems: An Overview

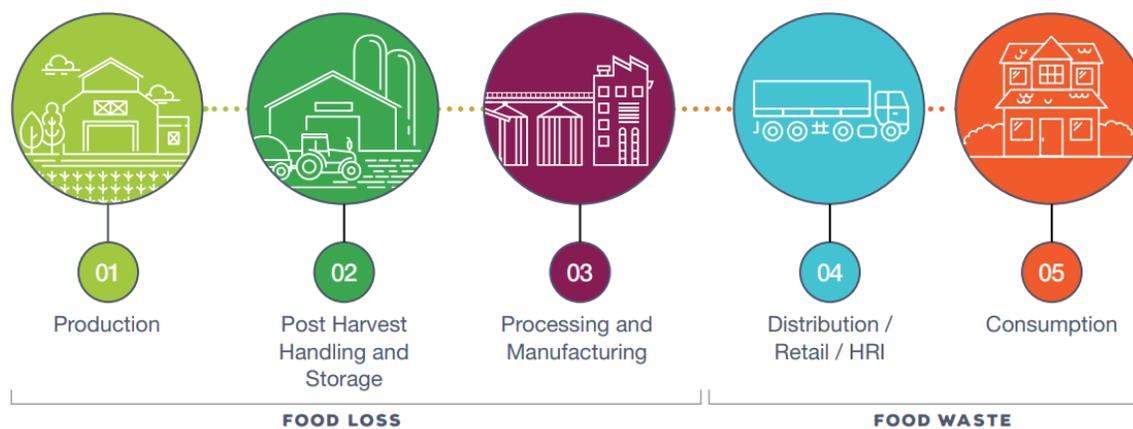
While there is no standard definition of what encompasses a circular food system, overarching circular economy principles can be applied to the food sector, with a focus on:

- Regenerating natural systems that support primary food production (e.g., regenerative agriculture and sustainable aquaculture);
- Keeping food and nutrients in their highest and best use throughout consumption while recapturing lost value; and
- Designing out food waste and pollution from the value chain.⁶

A circular food system is based on biological inputs and the use of renewable materials and seeks to prevent, recover, and/or repurpose waste. Food loss and food waste are defined differently, based on where they occur within the value chain. Food loss takes place during the production and processing stages, while food waste occurs during distribution and/or at the retail, food service, and consumption stages (see Figure 1).

However, with respect to a more circular food system, waste (or lost value) should be considered more broadly than just food loss and waste – essentially across four realms:

- Wasted resources (i.e., the use of resources and energy that cannot be continually regenerated);
- Wasted or underutilized assets (e.g., equipment that sits idle or trucks that return from their deliveries empty);
- Wasted life cycles (i.e., the premature end of use of products or assets given lack of repair, maintenance, and/or reuse and adaptability); and
- Wasted embedded value (i.e., resources, materials and/or energy not recovered at the end of use).



Source: Second Harvest and Value Chain Management International (2019). "The Avoidable Crisis of Food Waste".⁷

Figure 1: Overview of the distinction between food loss and waste.

⁶ Smart Prosperity Institutes December 2021 Report: "A Circular Agriculture and Agri-food Economy for Canada".

⁷ Second Harvest and Value Chain Management International (2019). *The Avoidable Crisis of Food Waste*.

Increasing circularity within the food system requires an approach that involves all stakeholders across value chains, and can be achieved through a number of strategies and approaches focused on eliminating waste (in all of its forms). The strategies and practices outlined in Table 1 focus on regenerating natural systems, designing out and preventing waste, as well as prioritizing food recovery by putting value on secondary materials and resources.

Table 1: Strategies, approaches, and best practices in support of a circular food system.

Strategies	Approaches	Best practices
Circular Inputs & Reduced Resource Consumption	Regenerative agriculture and circular inputs	<ul style="list-style-type: none"> • Regenerative agriculture • Renewable energy for operations • Renewable materials (e.g., bio-based packaging) • Recycled content in products and packaging • Organic nutrients and fertilizers
	Eco-design	<ul style="list-style-type: none"> • Agro-ecology • Zero waste grocery stores and delivery
	Responsible consumption and procurement	<ul style="list-style-type: none"> • Consumer awareness • Discounting soon to expire food items • Sustainable food choices (e.g., plant-based proteins, eco-labelled seafood) • Sustainable procurement
Sharing Platforms & Product As a Service	Sharing economy	<ul style="list-style-type: none"> • Cooperative supermarkets • Food sharing and resource exchange platforms • Labour sharing • Equipment and asset sharing
	Leasing models	<ul style="list-style-type: none"> • Asset leasing models • Equipment renting
Product Use Extension / Extending the Life of Resources	Process optimization	<ul style="list-style-type: none"> • Shorter / local supply chains • Precision agriculture (e.g., agrimetrics yield tracking) • Digital food waste tracking • Water, nutrient, and energy efficiency measures
	Maintenance and repair	<ul style="list-style-type: none"> • Proactive maintenance (asset management) • Secondary product markets
	Refurbishing	<ul style="list-style-type: none"> • Equipment refurbishment
	Secondary Processing	<ul style="list-style-type: none"> • Processing by-product into new food products
Resource Recovery	Resource and energy recovery	<ul style="list-style-type: none"> • Food resource recovery • Upcycled food products • Nutrient recovery and cycling (e.g., animal feed, composting) • New products from by-products • Energy recovery (e.g., anaerobic digestion, biogas capture, waste-to-biofuel production) • Reverse logistics
	Industrial ecology	<ul style="list-style-type: none"> • Agri-food industrial eco-parks • Industrial symbiosis

Source: Adapted by the Delphi Group from Circular Economy Global Sector Best Practices Series on Agri-food, Smart Prosperity Institute (February 2021)

3. Circular Food Economy: The Canadian Context

3.1 Current Snapshot

Economic Contributions

Canada's food system—including all the enterprises that produce, process, sell, and deliver food—is one of Canada's most important economic sectors, generating \$139 billion in GDP (7.4% of Canada's total GDP) in 2020 and employing 2.1 million people (equal to 1 in 9 jobs).⁸

Primary agriculture in Canada includes the production of many commodities including field crops (e.g., grain, oilseeds); animal products (e.g., meat, poultry, and dairy); and horticulture crops (e.g., fruits and vegetables). Canada had more than 193,400 farms in 2020, with the largest 10% of farms generating two-thirds of all revenues.⁹ Just over half of all farms (i.e., 56%) are small in size, earning less than \$100,000 annually and contributing only 5% to the sector's total revenues.¹⁰

In addition to land-based agriculture, Canada has one of the biggest fishing and aquaculture industries in the world.¹¹ In 2018, commercial fisheries (including both ocean and freshwater fisheries), contributed more than \$3.7 billion to Canada's economy and employed nearly 46,000 people.¹² In addition, Canada's aquaculture sector was valued at more than \$1.2 billion, an important industry for many small and coastal communities.¹³

Canada's food supply chains are also globally inter-twined. In fact, Canada is the fifth largest exporter of agriculture and agri-food products in the world, generating \$74 billion in export sales in 2020.¹⁴ The United States is Canada's top trading partner, accounting for more than half of all agri-food exports and more than half the country's imports.

Value of Food Loss & Waste

In Canada, the value of food lost or wasted every year has been estimated to be 35.5 million metric tonnes, accounting for 58% of total food produced.¹⁵ Of this, 32% is considered preventable (i.e., food that was produced as edible product that was never consumed), equal to 11.2 million metric tonnes and valued at \$49 billion – representing a tremendous opportunity to recover value.¹⁶ The balance, 68% or roughly 24.3 million tonnes, is classified as unavoidable (i.e., by-products of an edible food product that are not generally edible themselves, such as banana peels and animal bones).¹⁷

⁸ See: <https://agriculture.canada.ca/en/canadas-agriculture-sectors/overview-canadas-agriculture-and-agri-food-sector>

⁹ Ibid.

¹⁰ Smart Prosperity Institute (2021). *A Circular Agriculture and Agri-food Economy for Canada*.

¹¹ *Circular Food Solutions in Canada: A Coast to Coast Landscape Scan*.

¹² Ibid..

¹³ Library of Parliament (2021) "Executive Summary- Canada's Aquaculture Industry" Government of Canada

¹⁴ See: <https://agriculture.canada.ca/en/canadas-agriculture-sectors/overview-canadas-agriculture-and-agri-food-sector>

¹⁵ Second Harvest and Value Chain Management International (2019). *The Avoidable Crisis of Food Waste*.

¹⁶ See: <https://www.cbc.ca/news/canada/toronto/food-waste-report-second-harvest-1.4981728>

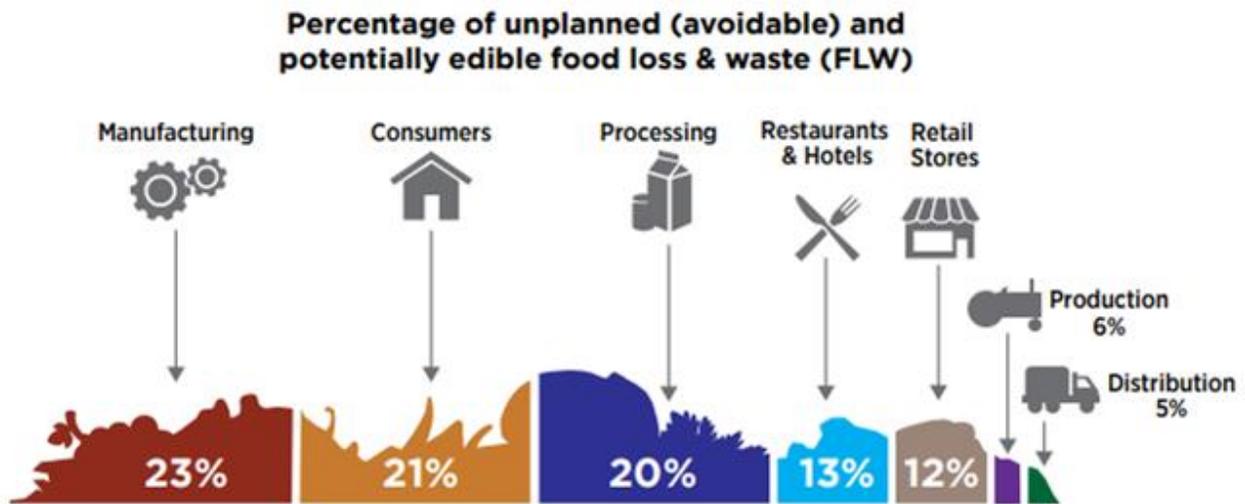
¹⁷ Second Harvest and Value Chain Management International (2019). *The Avoidable Crisis of Food Waste*.

Avoidable food loss and waste occurs throughout the value chain, with the primary sources being manufacturing, households, and food processing (see Figure 2).¹⁸ It is estimated that preventing food waste in the supply chain could reduce the cost of food to Canadian consumers by 10%.¹⁹

Environmental Impact

The current environmental footprint of the today’s linear food system is large, with impacts on land, water, and the atmosphere. The agricultural sector is the largest consumer of freshwater, as well as a large producer of wastewater. The overuse of fertilizers, pesticides, and herbicides contaminates soils and reduces its productivity over time.

The food industry is also key contributor to climate change, responsible for almost one quarter of global greenhouse gas (GHG) emissions.²⁰ In Canada, the agriculture sector contributed to approximately 8%²¹ of Canada’s GHG emissions in 2019, including from farming practices that rely on fossil fuels, as well as inputs such as fertilizers, pesticides, and the use of plastics.²² In addition, food waste currently sent to landfill in Canada is responsible for another 2% of the country’s GHG emissions.²³ It has been estimated that preventing food waste in the supply chain could avoid 56.5 million tonnes of carbon dioxide (CO₂) equivalent.²⁴



Source: National Zero Waste Council’s “A Food Loss and Waste Strategy for Canada”, 2018 (based on data from VCM International).²⁵

Figure 2: Food loss and waste throughout Canada’s food value chain.

¹⁸ National Zero Waste Council (2018). “A Food Loss and Waste Strategy for Canada” (based on data from VCM International).

¹⁹ Gooch, M. V., Dent, B., Felfel, A.-S., Vanclief, L., Whitehead, P., & Glasbey, C. S. (Ed.). (2016). *Food Waste: Aligning Government and Industry Within Value Chain Solutions*. VCM International.

²⁰ Ellen MacArthur Foundation. (2019). *Cities and Circular Economy for Food*.

²¹ Environmental and Climate Change Canada (2021) “Greenhouse Gas Sources and Sinks: Executive Summary 2021” Government of Canada.

²² Second Harvest and Value Chain Management International (2019). *The Avoidable Crisis of Food Waste*.

²³ Ibid.

²⁴ Ibid..

²⁵ National Zero Waste Council (2018). “A Food Loss and Waste Strategy for Canada”.

3.2 Circular Food Value Chain

The value chain for a circular food system in Canada involves many stakeholders, including the organizations involved in the following activities: Regenerative agriculture / aquaculture and sustainable production; food and beverage manufacturing and processing; food distribution; retail and food services; food resource recovery; and organics management and diversion. The sub-sections below provide a high-level overview of the current food value chain in Canada from a circular economy perspective.

Sustainable production

Today's largely linear approach to primary production and agriculture in Canada puts enormous pressure on soil and water, impacting productivity levels and the environment. It also results in an enormous amount of waste. As an example, it is estimated that over 660,000 tonnes of food produced in Canada each year are left unharvested.²⁶

Regenerative Agriculture

Regenerative agriculture is a key pillar of a more circular food system. Regenerative agriculture involves using a holistic approach to primary production, using alternative farm practices to conventional farming to reverse and prevent ecosystem damage through human activities. It includes practices such as no-tillage, cover cropping, crop rotations, soil amendment with compost and/or manure, and strategic grazing. These practices when combined can bring a number of benefits, including improved soil health, improved water quality, and increased biodiversity.

Canada has seen an increase in regenerative agriculture practices in recent years – nearly 100 regenerative agriculture farms are identified by Regeneration Canada across the country. However, these represent only a very small percentage of the nearly 200,000 farms in Canada in 2020.²⁷

Regenerative agriculture practices using modern tools play a critical role in the fight against climate change, with Canadian farmland having a large potential for acting as a carbon sink²⁸. As one example, research out of Saskatchewan found that growers in that province were able to sequester 8.75 million tonnes of CO₂e per year using minimal or zero-tillage practices on 23 million acres of farmland.²⁹ With this in mind, the Government of Canada earmarked \$270 million in its April 2021 federal budget to support agriculture and climate-smart solutions, including for regenerative farming.³⁰

SNAPSHOT: TapRoot Farms

TapRoot Farms is a 280-acre, family-owned farm that has adopted the UN Sustainability Development Goals (SDGs) as a framework for decision-making and as a tool for farm planning. The farm produces both certified organic and non-organic produce that is available for purchase at local retailers, and through a community shared agriculture (CSA) program.

Regenerative farming practices used on the farm include: 3-5 year crop rotations; reducing tillage; cover cropping; and use of animal manure; and composting of cardboard and vegetable trimmings.

²⁶ National Zero Waste Council (2020). [A Case for Waste Prevention in Canada Report](#).

²⁷ [Circular Food Solutions in Canada: A Coast to Coast Landscape Scan](#).

²⁸ See: <https://www.sciencedirect.com/science/article/abs/pii/S0016706118305755>

²⁹ See: <https://poga.ca/images/pdf/research/2018/PSCB%20Report%20-%20June%2018%202019.pdf>

³⁰ See: <https://www.canada.ca/en/agriculture-agri-food/news/2021/04/minister-bibeau-and-minister-carr-join-prairie-farmers-to-discuss-on-farm-climate-action-investments-in-budget-2021.html>

Sustainable Fisheries & Aquaculture

With respect to aquaculture, while there is no certification for circularity, the Aquaculture Stewardship Council (ASC) is a recognized global certification for environmentally and socially responsible aquaculture farms, having certified 37 farms in Canada.³¹ Integrated Multi-Trophic Aquaculture (IMTA) practices are aligned with circular approaches. IMTA involves growing finfish, shellfish, and kelp (seaweed) together, thereby mimicking nature where one species finds a feeding niche in the waste generated by another species, leading to efficient use of nutrient inputs and the generation of various ecosystem services. It also provides for greater food security and resiliency in that it generates multiple revenue streams that can mitigate the risk of raising only a single species for harvest.

Local Production

It's important to recognize that many circular and sustainable agriculture practices are not new to Canada; in many instances, they've been practised by older generations and Indigenous communities before industrial agriculture became the norm. Many remote, northern, and Indigenous communities are reinvigorating cultural practices that support local food production, as well as adopting local solutions such as rooftop and community gardens, farmers markets, community fridges and freezers, greenhouses, and hydroponic/aquaponic systems (see snapshot on ColdAcre Food Systems).³²

Shortening supply chains can also support food security, so long as a dependency on a single or small number of sources does not increase the risk around supply and resiliency. Shortening supply chains has the added benefit of reducing transport-related GHG emissions.

SNAPSHOT: ColdAcre Food Systems

ColdAcre has developed its CropBox solution – a high-productivity hydroponic garden in a retrofitted 40-foot shipping container. This containerized agriculture solution can produce up to 18,000 pounds of fresh produce year-round in any climate, using 90% less water and 80% less fertilizer than conventional agriculture methods.

This localized food production cuts down the carbon footprint of food transportation and also represents an economic opportunity for communities to improve food resiliency while providing employment.

Lastly, many of the regenerative and sustainable production practices in Canada are supported by clean technology solutions that help minimize the environmental impact of primary production, such as enhanced water treatment and soil management solutions, as well as precision agriculture technologies. The repair, reuse, and sharing of agricultural equipment and tools also support circular strategies by reducing assets that sit underutilized.

Food manufacturing and processing

Canada's food manufacturing and processing sector includes 7,800 companies (91% with under 100 employees) and employs nearly 300,000 people – with one-third of production going toward exports.³³ Another 26,500 people are employed in the fish and seafood processing sector, which includes product preparation and packaging facilities.³⁴

³¹ See: <https://www.asc-aqua.org/find-a-farm/>

³² Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

³³ See: <https://agriculture.canada.ca/en/canadas-agriculture-sectors/overview-canadas-agriculture-and-agri-food-sector>

³⁴ Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

The sector is largely ‘linear’ at present, with approximately 47% of total food loss and waste occurring during the manufacturing and processing stages (equal to 16.8 million tonnes of food loss).³⁵ There are many reasons that food loss occurs at this stage, from issues related to spoilage, to processing and equipment inefficiencies, inaccurate supply and demand forecasting, and misalignment related to current standards of quality.³⁶

At the same time, many businesses operating in this sector in Canada, from large multi-nationals (see snapshot on Maple Leaf Foods) to smaller processors and manufacturers, are focusing on improving their circularity and reducing their environmental footprints through efforts such as better demand forecasting, improving processing and manufacturing operations and equipment, and finding ways to utilize by-products (see snapshot on LOOP Mission).

SNAPSHOT: Maple Leaf Foods

Maple Leaf Foods is one of Canada’s largest food companies – and a major food processor. The company has committed to reducing food loss and waste (FLW) arising from its operations by 50% by 2025.

The company has been conducting FLW assessments to help develop a consistent standard to collect data, identify opportunities for reduction, and improve processing efficiencies. Its 2020 diversion rate was 91.6%, diverting nearly 199,000 metric tonnes of organic waste from landfill.

The company has also reduced its FLW intensity by 31% since 2016 and is focused on applying circular strategies to its operations more broadly, including with packaging and transportation / logistics.

While capacity is an issue for many of the smaller food and beverage processors, consultants and support programs do exist. As one example, Enviro-Stewards and Provision Coalition recently supported 50 Canadian food and beverage processors in finding opportunities to save \$11.4 million of additional profit, 9.3 million kilograms of food loss (equal to 15.4 million meals), and 32,600 tonnes of embedded GHG emissions.³⁷

Transportation and distribution

The geographic area where food is produced determines the length and complexity of food supply chains and, in turn, the related considerations around transportation and distribution. The total FLW impact at the distribution stage is relatively small, accounting for only 2% of total food loss and waste across the value chain in Canada.³⁸

Growing efficiencies in terms of transportation solutions and technologies (such as digital tools, just-in-time delivery processes, and cold storage) are also helping to enable more circular practices and eliminate food losses, although opportunities exist to improve in areas such as greater shipping efficiencies and product handling, as well as in reverse logistics and redistribution.

SNAPSHOT: LOOP Mission

Quebec-based LOOP Mission is a circular economy project that aims to reduce food waste by repurposing the outcasts of the current food industry. The organization makes cold pressed juices from fruits and vegetables that are rejected because they don’t have the ideal shape, size, or a shelf life that is not long enough to survive the cycle of distribution. LOOP Mission transforms them into awesome cold pressed juices. In addition, they are brewing beers with day old bread, distilling gin using potato cuttings from a potato chip factory, and making hand-crafted soaps from rejected cooking oil.

³⁵ Second Harvest and Value Chain Management International (2019). “The Avoidable Crisis of Food Waste: Roadmap”.

³⁶ Circular Food Solutions in Canada: A Coast to Coast Landscape Scan, p.32.

³⁷ See: <https://clean50.com/projects/enviro-stewards-provision-coalition-preventing-manufacturing-food-loss/>

³⁸ Second Harvest and Value Chain Management International (2019). “The Avoidable Crisis of Food Waste: Roadmap”.

Retail and food services

Combined, retailers and food service providers (e.g., restaurants and catering businesses, hotels, and institutions) are responsible for 13% of FLW in Canada, equal to 4.4 million tonnes of food waste annually – with approximately two-thirds of this coming from the food services segment valued at nearly \$7.4 billion per year.³⁹

For retailers, key issues that act as barriers to a more circular system include supply chain management and packaging issues, an over-supply of items, and consumer perceptions (e.g., poor produce aesthetics, best before dates, and/or partly-filled shelves resulting in a hesitancy to purchase). With respect to food services, primary issues include wasteful preparation practices and/or poor menu design, as well as customer consumption habits (e.g., plate waste).

Leading food retailers in Canada have committed to tackling packaging issues, improving supply chain efficiencies and sales forecasting, supporting sustainable producers, and setting aggressive targets to eliminate food waste (see snapshot on Save-on-Foods). In the food services segment, leaders are connecting with local suppliers and measures such as conducting waste audits to identify and prevent waste.

Food recovery and redistribution

In Canada, there exists an over abundance of food and waste, yet often an inability for people to access healthy and affordable food. This represents a hallmark of a food system that is not working effectively.

Canada has seen an increasing interest in and expansion of food rescue and recovery programs in the last several years – from farms through to retail and food services. In fact, there are currently more than 61,000 non-profit entities providing food to Canadians at low or no cost, compared to 15,344 grocery stores.⁴⁰ Non-profit organizations distributed an estimated \$33 billion worth of food in 2020, which would have made them the second largest grocery store in the country by sales. Some food recovery organizations are also involved with culinary education, community kitchens, advocacy, and other programs.⁴¹

Examples from across Canada include Second Harvest, Mustard Seed, Food Stash, Under One Roof, and Food-Mesh (see snapshot). While some programs are hyper-local, others such as FoodMesh and Second Harvest are working nationally with a priority focus on food recovery for human consumption. That said, when not fit for humans, the resources are often redistributed and converted for animal feed, compost, or upcycled into other valuable non-edible products.

SNAPSHOT: Save-on-Foods Working Toward Zero Food Waste

A big focus for Save-On-Foods, a major grocery retailer in Western Canada, is food waste. After meeting its first food waste reduction goal six years ahead of schedule, the company is now targeting zero food waste by 2022. The company has adopted three key approaches to its food waste and recovery efforts:

- Preventing surplus and potentially wasted food
- Responding to food waste reduction performance
- Diverting to the best and highest use in partnership with FoodMesh and others

Its efforts have allowed the company to reduce its carbon and environmental footprint while recovering more than 10 million kilograms of food to food banks and farms since February 2018.

³⁹ Second Harvest and Value Chain Management International (2019). “The Avoidable Crisis of Food Waste: Roadmap”.

⁴⁰ Second Harvest (2021). “Canada’s Invisible Food Network”.

⁴¹ Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

SNAPSHOT: FoodMesh Food Recovery

FoodMesh is a Vancouver based B Corp and food recovery platform servicing businesses and municipalities across Western Canada. They offer a suite of digital tools and services for businesses along the supply chain to divert unsold food to alternative markets in order to reduce waste and feed more. Services include a B2B marketplace that helps sell or donate surplus wholesale products to a network of alternative buyers and charities, a retail organic diversion program, as well as a Regional Food Recovery program for municipal governments seeking to support their food waste reduction and organic ban bylaws,

To date, the FoodMesh network of 2,500+ registered organizations has collectively diverted over 16 million KG of unsold food from landfills, abated 40 million KG of GHG emissions, rescued 23 million meals since 2017, with a rescue rate of 1 million meals/month, and created over \$850K in revenue sharing with our charity partners.

Collectively, these programs are rescuing millions of tonnes of food annually for those in need. Much of this redistribution has been enabled by better data and digital platforms which help to better match the demand (need) with supply of available and surplus resources. Key challenges to scaling more efficient food recovery models in Canada include costs, transportation and logistical issues, as well as the lack of connections and organized networks of food recovery actors.⁴²

Organics diversion and resource recovery

Opportunities for the diversion, reuse, and upcycling of FLW resources exist across the entire food value chain. The well-established 'food and waste recovery hierarchy'⁴³ prioritizes FLW prevention, followed by recovery or secondary processing for consumption purposes, with the remaining organic materials being diverted from landfill through recycling and lastly recovery measures (i.e., nutrient and energy recovery). Recycling and recovery initiatives, while lower priority, are at times the only option for managing organic streams and food waste.

Not only does diverting FLW from landfills help mitigate methane emissions generated during organic waste decomposition, but it also creates new economic opportunities inline with the circular bioeconomy. In 2015, 8.8 million metric tonnes of biomass were sourced from agriculture in Canada, valued at more than \$1.5 billion.

The economic, investment, and job creation opportunities that stem from this circular business strategy focused on resource recovery are extremely diverse, providing benefits to small and large businesses alike, as well as to rural, Indigenous, and urban communities across Canada. The wide range of valuable products from recovered organic waste streams include plant-based plastics, biocomposites, chemicals, pharmaceuticals and nutraceuticals, cosmetics, textiles, organic fertilizers and other nutrients, biofuels, and biogas to energy (e.g., from anaerobic digestion and methane capture).⁴⁴

SNAPSHOT: 3F Waste Recovery

Designed as a circular economy business, 3F Waste Recovery, based in Main Brook, Newfoundland, takes a systemic approach to tackling waste management challenges and turning these into value-added, socio-economic opportunities.

The company applies both traditional and new, innovative manufacturing solutions, such as to transform harvest waste from fish, farm, and forest (3F) into products that can be sold in established markets where there is growing demand. 3F Waste Recovery has successfully diverted 20 MT of waste in the past 12 months and increased revenue by 400%.

⁴² Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

⁴³ See page 41 from the Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

⁴⁴ Canada's Bioeconomy Strategy: Leveraging Our Strengths For A Sustainable Future (2019). See: https://uploads-ssl.webflow.com/602bf1483633ce3428a532a0/60624d51234d2ff1461f82a3_b22338_1906a509c5c44870a6391f4bde54a7b1-min.pdf

3.3 Enabling Ecosystem

Advancing a circular food system in Canada will require more than just a coordinated approach amongst the direct food supply chain stakeholders. It will only succeed through collaboration with the broader ecosystem, in particular governments and regulators at all levels, educational institutions, research agencies, industry associations and non-profits, financial institutions, and standards bodies.

Enabling ecosystem actors foster cross-industry and sector-wide collaboration, as well as provide platforms for sharing knowledge and exchanging information. Opportunities to learn from and scale best practice approaches will accelerate the circular transition.

Collaboration across the ecosystem in Canada includes circular strategies such as regional innovation hubs (see snapshot on Our Food Future initiative), labour or equipment sharing, data sharing platforms, and support for industrial symbiosis programs⁴⁵ that share ‘waste as a resource’ opportunities between companies and industries.

Training, capacity, and awareness building programs focus on a variety of aspects across the agri-food value chain, from primary production, to sustainable consumption, to the integration of Indigenous practices (see snapshot with a sample of education and training initiatives).

Lastly, the role of the enabling ecosystem, including governments at all levels, can not be understated as it is critical as an enabler for shifting the system away from the current linear status quo. Enablers include investments in infrastructure (e.g., organics collection and processing), supportive policies (such as funding programs and regulation), data transparency via open source information sharing platforms, and support for applied research and the innovation ecosystem (e.g., Agriculture and Agri-food Canada’s Food Waste Reduction Challenge Program⁴⁶ and the Proteins Industry Canada supercluster⁴⁷).

SNAPSHOT: Sample of Education & Training Initiatives

- **Northern Farm Training Institute:** Experiential farm school in the Northwest Territories that provides immersive training in regenerative agriculture to help build productive local farms and thriving resilient communities.
- **Sandown Centre for Regenerative Agriculture:** A education centre being developed on Vancouver Island, British Columbia, demonstrating regenerative agriculture practices to showcase ecologically, culturally, and economically sustainable food production.
- **The Charlton Sustainability Hub:** Experiential teaching hub in Northern Ontario that supports the sharing of Indigenous Traditional Knowledge and contemporary knowledge to promote the socio-economic sustainability of rural and remote communities through low-carbon living, resource diversification and circular economies.
- **Food Venture Program:** A 4-day online program which provides entrepreneurship education to new food and beverage business owners across Canada looking to increase their focus on sustainability. They offer courses that provide opportunities for businesses to circularize their businesses in multiple ways such as farm to retail programs, restaurant recovery, and uncovering hidden value.
- **Love Food Hate Waste Canada:** An information campaign in Canada launched in 2018 by the NZWC, in collaboration with campaign partners, with the goal of maximizing the value of food and helping Canadian food consumers reduce waste.

⁴⁵ One example of an industrial symbiosis program is the Symbiose agroalimentaire Montréal project, based in Montreal, Quebec, that is focused on the food processing sector. More here: https://crem.qc.ca/fr/project/symbiose_agroalimentaire_monteregie/

⁴⁶ See: <https://impact.canada.ca/en/challenges/food-waste-reduction-challenge>

⁴⁷ See: <https://www.ic.gc.ca/eic/site/093.nsf/eng/00012.html>

SNAPSHOT: Guelph Wellington's Our Food Future Initiative

Launched through Infrastructure Canada's Smart Cities Challenge program with an initial \$10 million investment, Our Food Future is serving as a catalyst for change within the regional food system. This regional initiative in Ontario is looking to create a sustainable, inclusive food system for local residents and business while building Canada's first smart data and technology-enabled circular food economy.

Our Food Future is focused on nine key pathfinder projects that cut across three areas of focus:

- Increasing access to a diversity of affordable, nutritious, and culturally relevant foods;
- Inspiring and creating a thriving, circular and regenerative economy through the support and development of circular businesses and business practices; and
- Respecting planetary and environmental boundaries by recognizing the impact and value of wasted resources.

In 2021, the Circular Opportunity Innovation Launchpad (COIL) initiative was launched as an innovation platform, test bed, and activation network aimed at creating, proving, and scaling transformative solutions that will move Canada toward a more sustainable, circular economy.

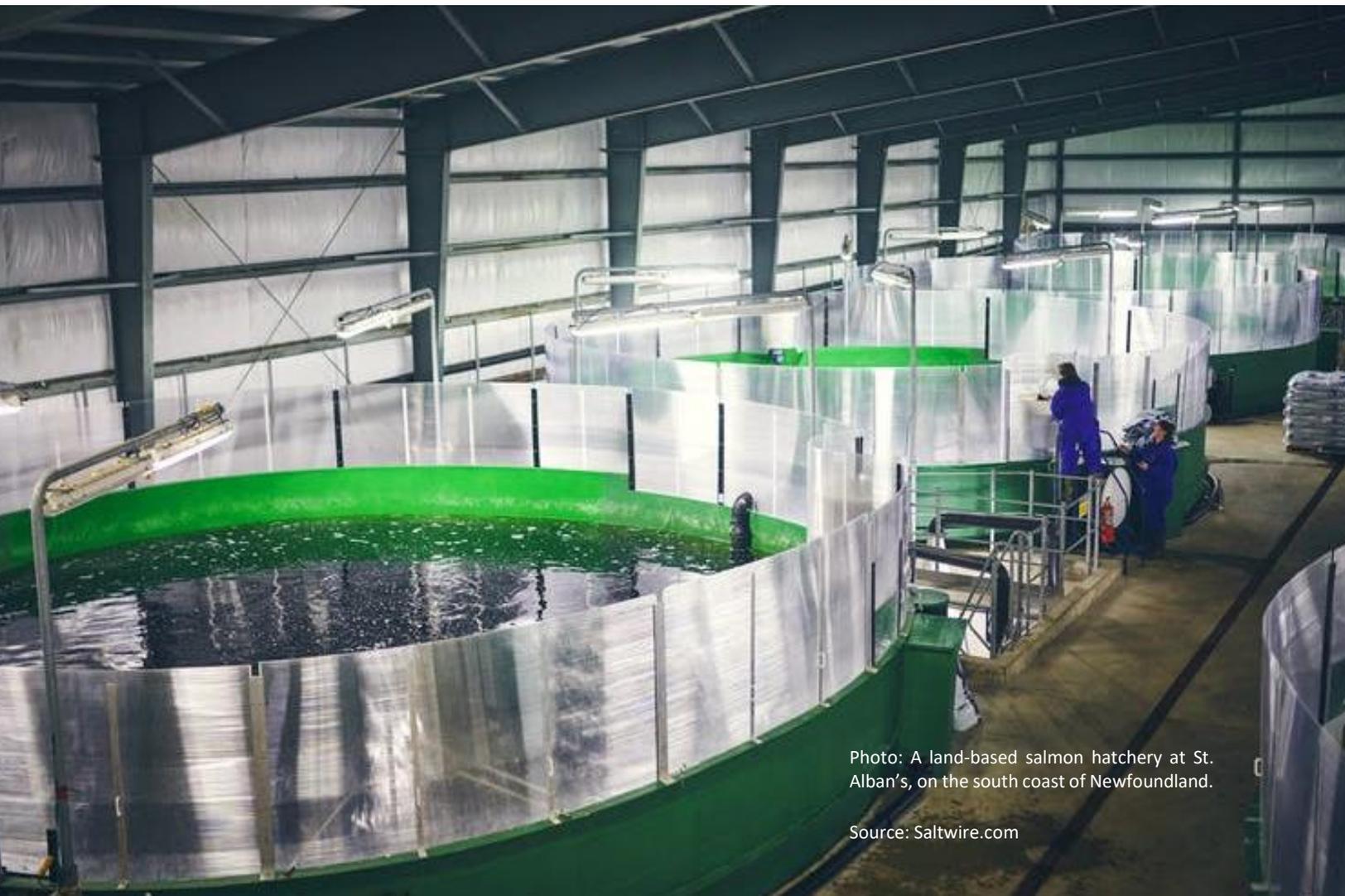


Photo: A land-based salmon hatchery at St. Alban's, on the south coast of Newfoundland.

Source: Saltwire.com

4. Barriers & Enablers

Much of the ongoing work to decrease the environmental impact of the food sector goes hand in hand with transitioning to a more circular food system – whether it is to support food producers, build local food processing and distribution infrastructure, increase transparency and traceability, develop supportive policies, or catalyze shifts in consumer behaviour. As presented in Table 2 below, many of the critical issues acting as barriers to a more circular food system in Canada are complex and often structural in nature. For the purposes of this Discussion Paper, they have been grouped across seven overarching themes and presented alongside system enablers.

Table 2: Key barriers and enablers for advancing a more circular food system in Canada.

THEMES	BARRIERS	ENABLERS
Collaboration and systems-thinking	<ul style="list-style-type: none"> • Siloed interactions within the supply chain • Competition acting as a deterrent to collaboration • Missing links to broader social and environmental trends • Entrenched pathways that reinforce status quo 	<ul style="list-style-type: none"> • Enhanced collaboration across sectors and value chains • Regional food hubs and other venues for information exchange and data sharing • Integration of traditional Indigenous practices and knowledge • Case studies and other demonstrations of successful alternative practices
Information and data ownership / access	<ul style="list-style-type: none"> • Opaque supply chains and lack of information • Proprietary approaches to information sharing • Lack of information to support informed procurement and consumer choice, such as standardized labelling • Gaps in food waste reporting 	<ul style="list-style-type: none"> • Emerging technologies, including digital platforms, sensors, and blockchain • Innovative cooperation models based on open-source data sharing platforms • Improved labelling and consumer information
Behaviour shifts and culture	<ul style="list-style-type: none"> • Lack of impetus for change • Unsustainable eating habits • Disconnect between consumers and the food system • Cultural norms 	<ul style="list-style-type: none"> • Education and awareness programs (K-12, etc.) • Role modeling and celebrity influencers • Incentives and cost factors to drive change • Behavioural insights and motivations – building awareness and demand for circularity • Local food culture, food sheds, circular community food systems
Innovation and technology	<ul style="list-style-type: none"> • Lack of investment in innovation and R&D to support circular food system approaches • Access to technology and capacity issues 	<ul style="list-style-type: none"> • Innovation challenge programs • Enhanced applied research linked to food system challenges • Capacity building to support SMEs with technology adoption and innovation • Living labs to test and support technology adoption
Policy and regulation	<ul style="list-style-type: none"> • Legacy of industrial food policy • Lack of policy harmonization • Regulatory uncertainty • Overcoming transitional regulatory costs • Challenges with EPR specific to food and packaging 	<ul style="list-style-type: none"> • Harmonized policy approaches and intergovernmental information sharing • Increased bans and disincentives on organics and food loss / waste • Policy support for sustainable farming and food practices • Circular procurement practices – public and private sector
Finance and investment	<ul style="list-style-type: none"> • Added cost of circular food solutions • Limited understanding of risk and ROI • Limited access to capital • Lack of accounting for social and environmental impacts (i.e., externalities) 	<ul style="list-style-type: none"> • Engaging with finance sector to improve access to capital • Leveraging taxation and financial incentives • Addressing externalities through true-cost accounting • Social finance to encourage innovation
Critical infrastructure	<ul style="list-style-type: none"> • Fragile industrial food infrastructure • Infrastructure gaps in remote communities • Lack of organic collection infrastructure 	<ul style="list-style-type: none"> • Invest in more resilient infrastructure solutions • Develop innovative funding models to address infrastructure gaps • Partnerships between urban centres, rural, and remote communities

5. Scaling a Circular Food System in Canada

Based on leading work by the Ellen MacArthur Foundation⁴⁸, fundamentally redesigning food product portfolios with circularity in mind – with the goal of using all of the diverse outputs of a nature-positive food system and sourcing them through regenerative production – offers significantly greater benefits than using the same ingredients as today in terms of addressing biodiversity loss, reducing GHG emissions, increasing total food output, and increasing profitability for farmers.

In Canada, a convergence of priorities is placing a greater emphasis on the need for more circular practices in the food system, including efforts to support post-pandemic recovery and resiliency, ambitious export targets for the agri-food sector, goals for achieving net-zero GHG emissions by 2050, and enhanced health and social wellbeing. While many circular food related efforts and initiatives are underway across Canada, existing efforts are fragmented and often piece meal by sector as well as geography, as opposed to being more systems-focused.

In order to truly achieve a circular food system in Canada and realize the many benefits from this transition, the focus must build on current efforts to tackle food waste, including the existing *Food Loss and Waste Strategy for Canada* (see Snapshot) to encompass the entire food production, supply, and management ecosystem in Canada.

Existing approaches and efforts, often at the local and regional levels, must be linked together and small wins scaled up in order to provide new opportunities that will allow communities, large and small, urban and rural, and from coast to coast to coast, to connect around their food cultures and place-based identities.

The high-level recommendations below summarize a number of key actions required for scaling circular food systems in Canada, including partnerships, innovation, policy, and investment.

SNAPSHOT: A Food Loss & Waste Strategy for Canada

Developed by the NZWC and other key stakeholders, A Food Loss and Waste Strategy for Canada was developed with the goal to reduce both food loss and waste by 50% by 2030 in alignment with Sustainable Development Goal 12.3 and the U.S. domestic target. It is anchored by three broad objectives:

- Prevent food waste from occurring in the first place;
- Recover safe and nutritious food for people and food scraps for animals; and
- Recycle energy and nutrients from the remaining, unavoidable food waste.

Focus Area	Recommendations
System-wide	Expand land access mechanisms that protect circular production practices (e.g., regenerative agricultural land reserve, community supported agriculture, land co-ops, etc.).
	Prioritize urban planning and design considerations, such as zoning that allows for more integrated land use / co-location, urban production and equitable distribution.
	Support regional / community-based food systems and equitable access, including enabling Indigenous food system practices and spaces.
Partnerships	
Collaboration and systems thinking	Form regional coalitions to support environmental, economic, and social outcomes through institutional procurement.
	Invest in virtual and physical platforms that allow direction connection between consumers and supply chain actors.

⁴⁸ See: <https://ellenmacarthurfoundation.org/resources/food-redesign/overview>

Better information and data	Advance voluntary and mandatory labeling standards to support consumer shifts toward more sustainable options.
	Establish a standard food loss and waste methodology to enable consistent reporting and tracking progress to targets.
	Establish a public-private platform for data sharing and transparency.
Education / awareness building	Expand technical support and capacity building for SMEs.
	Support programs related to mentorship, entrepreneurship / business training, and workforce development.
	Invest in public education and advocacy campaigns to support behaviour shifts (e.g., celebrity chefs, Love Food Hate Waste, to counter negative perceptions, etc.).
Innovation	
Technology and scaling R&D	Invest in applied research partnerships and centres of excellence to connect researchers with industry and agri-food entrepreneurs.
	Support the adoption of circular technology across the ecosystem (e.g., precision agriculture technologies, food recovery networks and digital platforms, alternative protein solutions, etc.)
	Host competitions and industry challenges to connect commodity groups or components of the supply chain to increase circularity and reduce GHG emissions.
	Develop and support more equipment, infrastructure, and resource sharing platforms to support farmers and others across the supply chain.
Policy	
Strategic Policy	Update strategies at the regional and provincial level to align with other government priorities (e.g., economic recovery, climate action).
Regulations & Standards	Expand and strengthen extended producer responsibility (EPR) programs for food packaging, agricultural plastics, and equipment.
	Inform development of circular food standards at national and international scales.
	Remove unnecessary red tape to encourage innovation (e.g., expiry dates, special permits, zoning).
Economic Instruments	Foster innovation across sectors through tax mechanisms (e.g., research tax credits, carbon tax, taxing externalities, etc.).
	Create a schedule of steadily increasing tipping fees for organic waste and encourage businesses to use a shadow price to reflect the full cost of waste.
Procurement Policy	Support for circular food products and businesses through public procurement contracts.
	Set targets for local food content, upcycling, and other social outcomes through procurement.
Investment	
Finance and Investment	Improve access to capital / funding – business model innovation, investing in efficiency, for non-profits / social enterprises, etc.
Infrastructure Gaps	Strengthen and scale-up local food infrastructure (e.g., cooling, storage, four-season greenhouses, community gardens, processing, distribution, etc.).
	Support rural and remote communities by establishing regional food hubs to connect supply chain actors.

APPENDIX A: Deep Dive on Barriers & Opportunities

The barriers and opportunities are considered across 7 key themes in this Discussion Paper:

- Collaboration and systems thinking
- Information and data ownership / access
- Behaviour and culture shifts
- Innovation and technology
- Policy and regulation
- Finance and investment
- Critical infrastructure

Collaboration and systems thinking

Complex food and agriculture systems create challenges for achieving the necessary collaboration to see systemic shifts. At the same time, everyone is connected to food which creates an opportunity for collaboration and connection between unlikely partners. The global pandemic and increasing climate disasters have raised the collective awareness about self-sufficiency and changed expectations about food supply, leading to more resources available for rebuilding local and bioregional food systems. Collaboration is required within and between businesses in the supply chain; all levels of municipal, provincial, territorial, and federal government; public health agencies; Indigenous Nations and Indigenous-led organizations; and other community-based organizations.

Collective efforts to support traditional Indigenous food systems and techniques offer a unique opportunity to transition to more circular food systems while working towards reconciliation; for the dual purposes of food security and cultural revival. Indeed, many regenerative farming practices such as intercropping, agroforestry, and water management techniques are based on Indigenous land management and farming knowledge.⁴⁹ This presents an opportunity for actors across the food system to work together and incorporate Indigenous knowledge and principles of resiliency.

Barriers & Opportunities

BARRIER	OPPORTUNITY
<p>Lack of collaboration The food system is traditionally organized around commodities and discrete components of the supply chain and tends to work in siloes.</p>	<p>A connected and interdependent food system is supported by partnerships. This includes academic research to develop new technologies, partnerships to share resources and feedstocks, leveraging supply chain relationships to achieve efficiencies and reduce waste, and other community linkages.</p>
<p>Platforms for information exchange and collaboration</p>	<p>Support regional food hubs and other platforms that allow direct connection between consumers and</p>

⁴⁹ <https://nfu.org/2020/10/12/the-indigenous-origins-of-regenerative-agriculture/>

Lack of a venue for mutual information exchange between primary producers, processors, distributors, retailers.

Limited venues and capacity for collaboration between different types of organizations in the food system.

producers, a place to tell stories. Build trust and increase capacity through facilitated conversations and contracts between supply chain actors.⁵⁰

Priorities for network engagement include consumers, educational institutions, social service agencies, long-term care and hospitals, and groups working in food security.⁵¹

Leverage e-commerce platforms to support business-to-business (B2B) and business-to-business-to-consumer (B2B2C) approaches.⁵²

Exclusion of traditional Indigenous food systems

Many Indigenous communities have been forced to adopt European or industrial food and agriculture systems. Much of the traditional ecological knowledge of Indigenous peoples has been forgotten or disconnected from our current food system.

Opportunity for communities and regions to connect around reestablishment of Indigenous food sources and secure space for Indigenous food practices.⁵³ Respecting and centring Indigenous perspectives in the shift to circular food systems can lead to a more interconnected and reciprocal relationship with food producing lands and ecosystems.⁵⁴

Links to broader social and environmental trends

Food producers witness environmental impacts firsthand, and therefore seek to adopt more regenerative practices. Some of these practices take many years to deliver results, so they are more appealing to producers with a forward-thinking or long term approach.

Identify common goals and leverage the synergies between circular food systems and other related sustainability trends (e.g., climate adaptation and resilience, net-zero commitments, ESG, water management)

⁵⁰ <http://www.crfair.ca/closing-the-supply-gap>

⁵¹ <https://www.canada.ca/content/dam/eccc/food-loss-and-waste/FLW%20Workshop%20Summary%20Report%20ENG%20-%20FINAL.pdf>

⁵² <https://agriculture.canada.ca/en/international-trade/market-intelligence/e-commerce/e-commerce-and-digital-business-guide-canadian-food-and-beverage-companies/business-business-b2b-e-commerce-food-and-beverages>

⁵³ <https://www.vancouvereconomic.com/blog/news/a-guide-to-a-just-circular-economy-of-food-in-vancouver/>

⁵⁴ <https://www.vancouvereconomic.com/research/a-right-to-food-framework-for-a-just-circular-economy-of-food/>

Information, data ownership and access

Evidence-based strategy, planning, and policy-development are required to make a circular shift viable. This means filling data and information gaps related to the current state of supply chains, the risk and ROI of new practices, and the value of food lost and wasted.

Developing and adopting better tools and standards will allow segments of the food and agriculture sector to better track food through the supply chain, improve transparency and traceability, and make informed decisions about infrastructure investments. These tools need to be sophisticated enough to support complex global supply chains, while also able to be translated into economic considerations for the business community.

Barriers & Opportunities

BARRIER	OPPORTUNITY
<p>Opaque supply chains Many supply chains (and their related impacts) are not transparent or well understood because of their complexity and global reach.</p>	<p>Adopt standards and transparent accountability systems for CE activities (e.g., social procurement, food waste measurement, food security measurement), and incorporate traceable blockchain technology in supply chains.⁵⁵</p>
<p>Lack of packaging and labelling standards Many consumers want to make a conscious choice and buy products with a lower environmental footprint, but information available at the point of sale is limited. Additionally, a lack of standardization in food labeling and packaging can confuse consumers and result in good food being discarded and excess waste.</p>	<p>Technology and better systems of data sharing can advance labelling standards and help people take more factors into account when buying food. New technology can provide a more accurate indicator of when food actually spoils, thereby reducing unnecessary food waste.^{56 57}</p> <p>Advances in behavioural science and increased use of online platforms can also help nudge consumers towards more sustainable options.</p>
<p>Gaps in food waste reporting Stakeholders lack a common starting point for defining food waste and associated GHG emissions produced through the supply chain.</p> <p>The low cost of waste disposal does not motivate solutions as SMEs often lack the capital required to invest. Regardless of the preferred metric (weight, dollars, per capita, etc), we need a standard methodology that also aligns with global protocols and that drives changes throughout the supply chain.⁵⁸</p>	<p>Establish a standard FLW metric that easily translates into dollars saved and emissions avoided. Businesses that see FLW impact their bottom line are more likely to seek reductions; especially when they also understand how it affects their carbon footprint. By conducting FLW assessments and making this information more transparent businesses can use the data to inform their strategy around reducing FLW.</p>

⁵⁵ <https://www.ibm.com/blogs/blockchain/category/blockchain-in-food-safety/food-supply-chain/>

⁵⁶ See: <https://www.mimicalab.com/>

⁵⁷ See: <https://trellis.ag/>

⁵⁸ <https://www.canada.ca/content/dam/eccc/food-loss-and-waste/FLW%20Workshop%20Summary%20Report%20ENG%20-%20FINAL.pdf>

Behaviour and culture shifts

Food is intertwined with many cultural norms and behaviour patterns; some of which can be barriers to systemic change and the adoption of more sustainable production practices. These patterns include the stigma associated with edible food that is labeled as waste, food safety concerns associated with best before dates, and diets with large amounts of resource-intensive products like meat and dairy.

Barriers & Opportunities

BARRIER	OPPORTUNITY
<p>Unsustainable consumption habits Many retailers and consumers have developed stringent aesthetic standards for produce and preferences for resource-intensive meat and dairy products.⁵⁹</p>	<p>Education campaigns that consider the context and timing of choices, deeper engagement with the target audience, and using case studies and storytelling.^{60 61}</p>
<p>Disconnected consumers Many consumers have long been disconnected from the source of their food and the people involved in producing it. There is also a general lack of awareness and understanding about the benefits of a circular economy and the connection to daily food purchasing choices.</p>	<p>More than just information is needed to change behaviour in both industry and consumers. Businesses that foster connections to producers can increase justice and social components of circularity in the food system.⁶²</p>
<p>Lack of business leadership in cutting food waste Food waste is largely permitted in landfills and disposal fees are low. Over 75% of the food produced is lost through the value chain, and industry lacks a coordinated approach to addressing FLW.⁶³</p>	<p>A culture shift can happen in businesses across the supply chain to recognize important financial, social, and environmental benefits of cutting food waste.⁶⁴ Campaigns to reframe wasted food and byproducts as resources.⁶⁵</p> <p>Increase fees for dumping or ban organics in landfills and prioritize higher-value uses before organic waste goes in green bin (e.g., on-site compost, etc). Note that these approaches need to consider waste and emissions leakage into neighbouring jurisdictions and illegal dumping, which underscores the importance of working in regional partnerships and ensuring adequate compliance and enforcement resources.</p>

⁵⁹ https://pacecircular.org/sites/default/files/2021-02/circular-economy-action-agenda-food_0.pdf

⁶⁰ https://pacecircular.org/sites/default/files/2021-02/circular-economy-action-agenda-food_0.pdf

⁶¹ <https://www.eitfood.eu/blog/post/transitioning-to-a-circular-food-economy-the-solution-for-food-waste-and-food-loss#heading-5>

⁶² Example from coffee industry: <https://perfectdailygrind.com/2017/08/how-roasters-can-build-good-relationships-with-coffee-producers/>

⁶³ <https://provisioncoalition.com/assets/website/pdfs/Provision-Addressing-Food-Waste-In-Canada-EN.pdf>

⁶⁴ <http://www.nzwc.ca/Documents/NZWC-FoodLossWasteStrategy-EN.pdf>

⁶⁵ https://pacecircular.org/sites/default/files/2021-02/circular-economy-action-agenda-food_0.pdf

Innovation and technology

Innovation and new technology has long had a role in shaping Canada's food system. There is an opportunity to build on existing R&D to achieve circular outcomes, as well as expanding efforts beyond a technology focus to include considerations for product, business model, supply chain, and social innovation principles.⁶⁶

The tendency to emphasize yields and stick to existing practices, a risk aversion to unproven approaches, and operating within small profit margins are all barriers related to driving more circular food systems through innovation and technology.

Barriers & Opportunities

BARRIER	OPPORTUNITY
<p>Innovation funding Food and agriculture businesses in Canada rely much more on government funding for R&D compared to US firms.⁶⁷ It is difficult to deliver funding and apply technical solutions across the full spectrum of widely distributed SMEs.</p>	<p>Funding programs such as Agriculture and Agri-Food Canada's Food Waste Reduction Challenge award funding to business models and technologies that prevent or divert food waste. Promoting leadership through these programs can lead to friendly competition and inspire the broader sector.⁶⁸</p>
<p>Lack of knowledge about business model innovation Changing socio-economic conditions and international market forces require food and agriculture businesses to adapt, redesign, and reconfigure their approach to remain competitive.</p>	<p>Expand and promote awareness of accelerator, mentorship, and support services for agriculture and food businesses across the supply chain.⁶⁹ Providing supports to entrepreneurs can help them continue to innovate and attract a varied and skilled labour force.</p>
<p>Access to technology and production methods Due to the large number of small enterprises, lack of rural infrastructure, and limited knowledge sharing, added costs, and technological solutions that are underutilized.⁷⁰</p> <p>Regenerative farming methods reduce the need for fertilizers and pesticides, but may also yield less food per land area, depending on crop type and practices.⁷¹</p>	<p>Regenerative agriculture is well suited to small operations, with benefits such as improved soil and water quality and greater food security / health outcomes from higher nutrient levels.</p> <p>Businesses can implement innovative solutions such as biofertilisers, protein feed, adapted waste streams, and renewable energy sources.⁷²</p>

⁶⁶ <https://onlinelibrary.wiley.com/doi/full/10.1002/bse.2725>

⁶⁷ http://www.rbc.com/economics/economic-reports/pdf/other-reports/Farmer4_aug2019.pdf?_ga=2.86230173.446131698.1638572289-737371479.1638572289

⁶⁸ <https://impact.canada.ca/en/challenges/food-waste-reduction-challenge/semi-finalists>

⁶⁹ <https://www.fcc-fac.ca/en/about-fcc/media-centre/customer-stories/innovation-canadian-agriculture-food.html>

⁷⁰ https://pacecircular.org/sites/default/files/2021-02/circular-economy-action-agenda-food_0.pdf

⁷¹ https://pacecircular.org/sites/default/files/2021-02/circular-economy-action-agenda-food_0.pdf

⁷² https://ec.europa.eu/food/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf

Policy and regulation

Food systems are complex entities from a policy standpoint, with responsibility for different components falling across all levels of government. Positive benefits of circular food systems can help to achieve many social and environmental policy goals related to environmental protection, climate mitigation, adaptation and resilience, and local economic development. Government intervention is needed to support change in industry and overcome policy barriers across supply chains. Policy incentives can help to accelerate change through market mechanisms, technology, infrastructure, culture shifts, and applied research.

Barriers & Opportunities

BARRIER	OPPORTUNITY
<p>Legacy of industrial food policy Outdated regulations can impede circularity when they prohibit the exchange or reuse of certain products and materials. Low tipping fees at landfills is an example of a disincentive to R&D and efforts to divert or recover food waste.</p> <p>Government regulations designed for conventional practices may unintentionally impede more circular practices, such as health and safety requirements that require a large economy of scale (e.g., abat-toirs).⁷³</p>	<p>Policy interventions to encourage a shift to circular food systems include supporting new ideas through research and innovation competitions; support for development, demonstration, and commercialization of solutions; stimulating demand through procurement and other policy tools; and coordinating the ecosystem around a shared vision for greater circularity.</p>
<p>Lack of harmonization and local capacity A disconnect exists between levels of government with regard to the regulatory authority of central governments and the ability of local government to implement solutions. Regulations and guidelines about waste and recycling are often specific to a city or region, but local governments lack the education and communication resources of a provincial or federal department. Circularity also requires scale – so while one local government may be implementing policies that support circular food solutions, the real impact is only felt at a larger scale, which requires harmonized policy across jurisdictions.</p>	<p>Foster information sharing across levels of government and provide more resources and tools to communities to educate their populations about the limitations of their existing systems and infrastructure.⁷⁴</p> <p>Provinces can work together to set policy regimes that encourage circularity and can be implemented at a local level across jurisdictions.</p>
<p>Regulatory uncertainty Businesses and investors are hesitant to take risks if the near-term regulatory environment is unknown or unclear.</p>	<p>Regulations that include a step by step roadmap for implementation can encourage businesses to take action, simply through the motivation to ensure long term viability of their business. If a business has certainty about milestones and policy targets well into the future, they can make decisions today that align with those targets.⁷⁵</p>

⁷³ Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

⁷⁴ Ontario harmonizing blue box system and transitioning to EPR, surplus food redistribution infrastructure program: <https://www.ontario.ca/page/waste-management>

⁷⁵ <https://media.sitra.fi/2021/03/06134842/the-winning-recipe-for-a-circular-economy.pdf>

Overcoming transitional costs

Short term economic competitiveness is often a barrier to stronger environmental regulations.

Government can play a role in subsidizing desirable alternatives and taking on risk while economies of scale are established (e.g., alternatives to single-use plastic packaging, local food procurement targets).⁷⁶

Institutional procurement can affect change through the supply chain and create anchor markets for smaller entities to participate in. Carefully considered institutional purchasing practices can prevent FLW.^{77 78}

Challenges with EPR

Extended producer responsibility (EPR) regulatory models have been implemented with varying degrees of success, as regulatory definitions are limited by a complex global web of producers and sources.

Harmonize waste and recycling regulations across regions and levels of government and shift to extended producer responsibility (EPR) models where possible.

EPR regulations are more effective if accompanied by a clear definition of who is responsible for the treatment of waste streams, how funding is deployed, intended logistics around product collection, and penalties for non-compliance.⁷⁹

Finance and investment

Many food and agriculture SMEs are operating on small profit margins and are hesitant to take risks on new methods or capital infrastructure investments required to shift to circular solutions. Facilitated finance and investment partnerships between lenders, groups of small producers, and retailers can mitigate the risk and overcome barriers to transition. Opportunity also exists to translate the story into terms that can be understood by investors and communities alike.

Barriers & Opportunities

BARRIER

Limited understanding of risk and ROI

Food producers operating on low profit margins and potential funders are hesitant to take risks and invest the capital required to innovate.⁸⁰

OPPORTUNITY

Develop long-term and whole crop purchase agreements to equitably share risk between producers, distributors, and retailers.⁸¹ Partnerships between aggregated groups of buyers and sellers can shift the risk profile and ease market access for smaller producers and retailers.⁸²

⁷⁶ https://cpb-ca-c1.wpmucdn.com/sites.uoguelph.ca/dist/7/166/files/2020/06/DeLorenzo_Food-Waste.pdf

⁷⁷ <http://www.nzwc.ca/Documents/NZWC-FoodLossWasteStrategy-EN.pdf>

⁷⁸ <https://foodsecurecanada.org/resources-news/resources-research/leveraging-contracts-local-food-procurement-guide-institutions>

⁷⁹ https://cpb-ca-c1.wpmucdn.com/sites.uoguelph.ca/dist/7/166/files/2020/06/DeLorenzo_Food-Waste.pdf

⁸⁰ Circular Food Solutions in Canada: A Coast to Coast Landscape Scan.

⁸¹ https://pacecircular.org/sites/default/files/2021-02/circular-economy-action-agenda-food_0.pdf

⁸² Closing the Supply Gap, Ontario Food Terminal, Local Food Plus. <https://sustainontario.com/2010/04/15/the-future-of-food/>

Access to capital

Current expenses typically eat up most of the revenue from farm sales, which reduces producers' ability to invest in new technologies. Access to credit in Canada is also relatively low at 1.9% (global average is 2.9% and New Zealand is 14.1%).⁸³

Facilitate investment partnerships that build the capacity of producers to adopt regenerative and locally appropriate practices. Investments can also be linked to improved land and forest governance.

Funders can consider an appropriate balance between the scale of funding, administrative requirements, and capacity of applicants and supporting organizations.

Accounting for social and environmental benefits

The current market does not adequately recognize environmental and social benefits of circular solutions. Linear risks such as soil degradation and biodiversity loss are not incorporated in pricing models.

Use case studies to articulate co-benefits using the language of the financial sector (e.g., ESG, TCFD). Financial systems that recognize external risks and benefits lead to more sustainable long term investments.

Critical infrastructure

Much of our current food infrastructure is designed around efficient one-way logistics and enabling products to travel long distances from producer to consumer. At the same time, eating and purchasing habits for much of the current food supply relies on long distance trucking, rail, and air freight. Many products travel great distances to arrive through sea and air ports, or via truck from the U.S., and even domestic food distribution must contend with Canada's wide geography and relatively low population density. Linear East-West transportation links are vulnerable to increasing climate events, as shown by the flooding events in BC in November 2021.

Some of the challenges associated with our current food transport infrastructure include a dependence of fossil fuels and resulting GHG emissions, pollutants near roads and seaways, high levels of food waste, logistics and coordination challenges, degraded nutritional quality from harvest to consumer delays, and animal welfare.⁸⁴

Canada's food waste infrastructure also holds opportunities to be more circular, as existing systems are built around trucking away waste to a landfill and in some cases capturing the gas as it decomposes. While these systems have benefits in being able to serve large populations, smaller scale and closed loop composting solutions that prioritize nutrient recovery over energy recovery have a role to play in urban and rural areas.⁸⁵

⁸³ Farmer 4.0. See:

http://www.rbc.com/economics/economic-reports/pdf/other-reports/Farmer4_aug2019.pdf?_ga=2.86230173.446131698.1638572289-737371479.1638572289

⁸⁴ See: <https://foodpolicyforcanada.info.yorku.ca/goals/goal-5/sustainable-transportation/challenges-transport/>

⁸⁵ Victoria Compost Education Centre Neighbourhood Composting Program: <https://compost.bc.ca/programsresources/neighbourhood-composting-program/>

Barriers & Opportunities

BARRIER

Vulnerable industrial food infrastructure

Industrial food supply chains have developed to be long distance, fragile (i.e., vulnerable to disruption), and reliant on conditions outside of the control of the communities they serve.

Most of the food industry in Canada is made up of SMEs, but the economic activity is concentrated in a few large operations.⁸⁶ This power balance presents a challenge: how can circular food infrastructure meet the needs of small and large operations alike?

Infrastructure gaps in rural / remote communities

Food insecurity in remote communities that often have lower income levels is a product of unreliable supply chains, higher prices, and nutritionally depleted products. Common infrastructure gaps include cold storage, processing and packing facilities, equipment to capture post-harvest losses, access to growing environments that extend growing seasons, and internet access.⁸⁸

Organics collection services

Many households and businesses do not have access to organics collection services. Additionally, many waste streams are comingled and contaminated, reducing the potential to transform organic waste into higher value uses.

OPPORTUNITY

Rebuilding local and place-based supply chains that can exist alongside current industrial food infrastructure.⁸⁷

Strengthening and scaling local food infrastructure to support more local food production and local waste and recovery loops (e.g., community composting). Cooling, storage, and distribution infrastructure can also support circular food activity.

Investing in remote communities through increased food production and processing infrastructure to build resilience and make them less vulnerable to disruptive events outside of their control.

Time is of the essence in preserving the value of unsold food and byproducts. Processing infrastructure in close proximity to potential waste sources can allow for higher value recovery.

Newly established organics services can move past older models and implement solutions further up the food recovery and waste hierarchy. Multi-family dwellings can implement systems to avoid food loss and waste by sharing unneeded food among neighbours, and also use on-site composting solutions to avoid organic waste transport needs.

⁸⁶ Smart Prosperity Institute (2021). *A Circular Agriculture and Agri-food Economy for Canada*.

⁸⁷ <https://www.vancouvereconomic.com/research/a-right-to-food-framework-for-a-just-circular-economy-of-food/>

⁸⁸ Smart Prosperity Institute (2021). *A Circular Agriculture and Agri-food Economy for Canada*.

