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## SUMMARY

Canada's food system has evolved under pressure to constantly produce more and do so more efficiently. However, the drive for increased productivity has also led to rising levels of food loss and waste. In Canada, over half of our annual food supply is discarded. Wasted resources, economic costs, pollution and growing numbers of citizens who are food insecure underline the importance of tackling this critical public policy issue. The aim of this paper is to better understand food loss and waste in Canada's food system and offer suggestions for policy action.

Canada's food system is interconnected and food loss and waste occur at every level of the supply chain. They are the result of multiple and cumulative activities and the economic, social and environmental impacts are considerable. Consumers and businesses fail to adequately measure and account for the costs of waste and this is a reflection of how our society values food. There has been a general disregard for food loss and waste in the pursuit of maximizing output/economic growth, meeting market demands and keeping food prices low.

COVID-19's impact has shed light on the strengths and vulnerabilities of Canada's food system. Disruptions in our supply chains garnered media attention and food security concerns became top of mind for many Canadians. Diverting food can help alleviate food insecurity but it can also serve an important role in reducing food waste. However, there are key challenges to facilitating food rescue that have been highlighted and exacerbated over the last year, including lack of infrastructure and co-ordination, misconceptions about food safety and worries related to cost and liability.

Reducing the problem of food loss and waste in Canada's food system will require a unified strategy and committed leadership. Policy action should be directed at enhancing measurement, education, innovation and policy reform. Reducing avoidable loss and waste through policy measures that enable prevention and diversion will ultimately strengthen our food system by wasting fewer resources, finding new economic opportunities, preventing environmental damage and alleviating food insecurity.

## INTRODUCTION

Canadians benefit tremendously from our strong agriculture and agri-food industry. We expect abundance, variety and quality food at cheap prices when we go to the grocery store. In response, our food system has evolved under pressure to constantly produce more and do so more efficiently. Unfortunately, the drive for increased productivity has also led to rising levels of food waste. The abundant and stable supply of food in Canada has led to a general disregard for waste that occurs. Wasted resources, economic costs, pollution and growing numbers of citizens who are food insecure underline the importance of tackling this critical public policy issue.

Food loss and waste (FLW) occur throughout the supply chain. The problem is not recent nor is it confined to our borders. FLW is a global problem and no country is immune to its considerable economic, social and environmental impacts. In Canada, over half of the annual food supply, equivalent to 35.5 million tonnes, is lost or wasted and of that total at least 32 per cent (11.12 million tonnes) is identified as "avoidable" (Gooch et al. 2019).[1] The first section of this paper discusses FLW in Canada's food supply chain and some key reasons for it.

COVID-19's impact has shed light on the strengths and vulnerabilities of Canada's food system. Disruptions in our supply chains garnered media attention and food security concerns became top of mind for many Canadians. Media stories of millions of gallons of raw milk being dumped, produce crops destroyed and livestock euthanized provided shock value. Coinciding with grocery store shortages caused by stockpiling and sudden shifts to more at-home eating, consumers were outraged at the levels of waste being reported. The rising demand on food banks throughout the country also made it unsettling to see such levels of loss at the farm level when millions of Canadians were going hungry. These events brought attention to the food system and encouraged a public dialogue on food waste and its connection to food security. The second section discusses some of the key challenges to facilitating food rescue that have been highlighted and exacerbated over the last year.

Reducing FLW in Canada's food system requires policy action and government leadership. Assessing what we can do better to mitigate waste is a critical component of moving the dialogue forward and inciting policy change. The final section offers four policy suggestions that will help strengthen our food system by reducing food waste.

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1 "Avoidable" food waste is the edible food that ends up in the compost or garbage bin. "Unavoidable" food waste includes food that cannot be generally sold or eaten, such as bones, vegetable/fruit peelings, eggshells, tea bags, coffee grounds, etc.

## SECTION 1: FOOD LOSS AND WASTE IN CANADA'S FOOD SYSTEM

Food waste is defined as "all food that is grown, harvested, processed, manufactured or prepared for human consumption, but never eaten by people. It occurs at all stages of the food supply chain, from farm to plate" (Agriculture and Agri-Food Canada 2021a).[2] Within the dialogue, researchers often distinguish between food discarded in earlier stages of the supply chain; that is, production, transport and processing ("food loss"), and that thrown away at the retail stage and by consumers ("food waste"). Often, the distinction is blurred and terms used interchangeably among research. This paper uses the umbrella term "food loss and waste" (FLW) when referring to the problem as a whole.

In recent decades, FLW has increasingly been recognized as a global problem (von Massow et al. 2019). In March 2021, the United Nations Environment Programme (UNEP) reported that levels of FLW continue to rise around the world, in both developed and developing countries, and are reaching critical heights (UNEP 2021). With a global population expected to exceed nine billion by 2050, and the impact of climate change on primary production throughout the world, mitigating food waste is seen as a critical component of facilitating food security, environmental protection and using our resources strategically (UNEP 2021; Rutten 2013).

Research focused on FLW in Canada has produced valuable evidence about the growing problem within our domestic food system and the complexity of contributing factors. From 1961 to 2009, food waste at the retail and consumer levels increased by 40 per cent in relation to the food available for consumption (Abdulla et al. 2013). The most recent data suggest that the annual value of FLW in Canada's entire food system is an estimated $49.5 billion and when input costs (water, power, labour, etc.) are factored in, researchers project that a more accurate value is over $100 billion/year (Gooch et al. 2019). Food waste also burdens local governments in terms of land use and financial costs for waste management. In Alberta alone, the cost to dispose of food waste was approximately $500 million in 2017 (AAF 2017).

Food waste has a large environmental footprint. In landfills, organic waste breaks down in a low-oxygen environment, producing methane. The Canadian government reports that "methane is 25 times more potent than carbon dioxide in terms of its global warming potential" and "landfills account for 20% of national methane emissions" (ENR 2017). In 2015, food waste in Canadian landfills generated an estimated 30 megatonnes (Mt) of carbon dioxide equivalent ($eCO_2$) of which 19 Mt $eCO_2$ were ultimately emitted (ENR 2017).[3] A 2019 report, conducted by Value Chain Management International (VCMI) in partnership with Second Harvest, estimated that FLW throughout the food system was responsible for 56.5 Mt of

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2 Food loss and waste measurements generally account for liquids lost at the production and processing stage and beverages at the food service, retail and consumer stage.

3 In 2015, an estimated "11 Mt $eCO_2$ generated at landfills were captured — of which 5.4 Mt $eCO_2$ were combusted and 5.6 Mt $eCO_2$ were utilized for various energy purposes" (ENR 2017).

$eCO_2$, which accounted for nearly eight per cent of total greenhouse gas (GHG) emissions that year (ENR 2021; Gooch et al. 2019).[4] This statistic is similar to the global average of GHG linked to food waste in landfills (eight to 10 per cent) (UNEP 2021). The impact of rising levels of FLW will have serious and cumulative effects in the years to come if not addressed by governments across the world.

Despite the difficulties in accurately measuring the scale and nature of food discarded along the supply chain, researchers have done their best to identify major contributing sources and provide explanations as to where and why food is being wasted. Table 1 is adapted from a 2016 national study on food waste (Gooch et al. 2019). While these statistics are somewhat dated, they represent the most recent national data and analysis of the whole supply chain, which subsequent studies have built upon and often reference.

**Table 1: Volume and Value of Avoidable Food Loss in Canada's Supply Chain**

| Chain Location | Volume (million tonnes) | Value ($ Billion) | % of Total |
|---|---|---|---|
| **Production/Farm Level** | 0.66 | 2.88 | 6 |
| **Processing** | 2.25 | 9.78 | 20 |
| **Manufacturing** | 2.57 | 11.17 | 23 |
| **Distribution** | .55 | 2.41 | 5 |
| **Retail** | 1.31 | 5.7 | 12 |
| **Households** | 2.38 | 10.37 | 21 |
| **Hotels, Restaurants and Institutions** | 1.44 | 7.14 | 13 |
| **Total** | 11.17 | 49.46 | 100 |

Source: Adapted from Gooch et al. 2019 (p.86). % column calculated by author.

There is substantial and avoidable FLW, both in scale and value, at every stage of the supply chain (Gooch et al. 2019; Lipinski et al. 2013; Lundqvist et al. 2008). While the numbers vary among research, they all support one key point: the food system is interconnected and what drives waste at one stage affects another. The following discussion on FLW identifies three common themes in the dialogue and key drivers of rising FLW in Canada.

## FARMGATE WASTE DRIVEN BY EXTERNAL FACTORS

Canada's agriculture and agri-food system is a major economic contributor. In 2018, the industry generated $143 billion for the Canadian economy (7.4 per cent of national GDP) and provided one in eight jobs nationally (AAFC 2020c). Canada is

[4] The percentage was calculated using data from Gooch et al. 2019, *The Avoidable Crisis of Food Waste: Technical Report*, which estimated that FLW produced 56.5 Mt of $eCO_2$ in 2016, and data published by Environment and Natural Resources Canada (2021) that estimated the total for national GHG emissions in 2016 was 707 Mt of $eCO_2$. For a detailed breakdown of the methodology Gooch et al. use to calculate their estimate for each stage of the food system (production, processing, manufacturing, transportation, retail, hotels, restaurants, institutions and households), please refer to Appendix C of Gooch et. al 2019, 115–118.

also one of the largest exporters of agricultural products in the world. Government policies, applied science and technology have facilitated the goal of increasing supply for domestic and international markets and related economic growth.

Our entire food system depends on stable and abundant commodity production at the farm level. For example, fruit and vegetable farmers are often under contract and may overproduce to ensure they meet their obligations for quality and volume. One of the main reasons for discarding produce at the farm level is esthetic and grading standards. The size, shape, colour and nutrient content demanded by processors and retailers impact what is harvested and discarded on the farm (Kinach et al. 2020; Lucifero 2016). FLW is regarded as an "acceptable trade-off between field efficiency (lower production costs and faster operation) and increased yields" (Kantor et. al 1997).

The desire to produce bumper crops also reflects the financial strain that producers are under to keep their farm profitable. The cost of inputs (seed, fuel, machinery, chemicals, fertilizer, etc.) has been rising for decades and has not been proportional to the prices farmers receive in most sectors. Simply put, farmers have relied on increased yields to ensure their operations remain viable. Producing surplus to seize potential market demand can pay off. However, if there is surplus and no buyer, or market prices are poor, the cost of harvesting and storing can pose a greater financial burden than tilling a crop back into the soil (Priefer et al. 2016; Gunders 2012; Bloom 2010).

Farm production represents six per cent of the estimated total avoidable food waste in Canada (Gooch et al. 2019). This percentage is relatively low in comparison to other stages of the supply chain because diverting discarded food to other purposes is more typical. For example, a 2019 survey of produce farmers reported that land application, composting, anaerobic digestion and animal feed were primary destinations for diversion (Gooch et al. 2019). Primary producers also donate to community organizations such as food banks and routinely offer surplus left in fields for gleaning efforts.[5] Therefore, while food lost at the farm level is worth addressing, the issue with overproduction is quite minimal compared to other sources. Incentivizing and/or facilitating recovery/food rescue to other sources may be a valuable option for further policy action.

## CONSUMER DISCONNECT AND FOOD LITERACY

Urbanization, industrialization and globalization have created a disconnect between consumers and where their food comes from and how it is processed (CCFI 2019; Thyberg and Tonjes 2016). Many citizens take for granted the access and affordability that our food system generates. However, while societal attitudes

*5* The terms "gleaning" and "food recovery" are often used interchangeably. Field gleaning is the collection of crops from farmers' fields that have already been harvested or fields which are not economically profitable to harvest.

towards food waste are often generalized, how people value food is also a reflection of culture, generation and income (Gallant 2019; Thyberg and Tonjes 2016).

Consumers are one of the largest contributing sources of food waste and most are unaware of the amount they generate (Parizeau et al. 2015). Not only does the average Canadian household throw away between 79kg and 140kg/year of food (UNEP 2021; NZWC 2017) but consumer preferences and buying habits are intrinsically linked to food waste at other levels of the supply chain.

Canadian surveys consistently find that food affordability is a top life concern for the majority of citizens (CCFI 2020, 2016). Our food system has evolved to maximize output at the cheapest prices possible. In fact, Canadians pay some of the lowest food prices in the world (TWP 2020).[6] For example, between 2010 and 2019, the average Canadian household spent between 10 and 11 per cent of their total expenditures on food (Statistics Canada 2021a).

It is difficult to reconcile the concerns that Canadians have about the cost of food when the average household discards between $1,100 and $3,500 in food each year (Charlebois 2020a; NZWC 2017). In addition, FLW along the supply chain is claimed to be a factor in food pricing (AAF2 2017; Gooch and Felfel 2014). How, and to what extent, FLW influences food price dynamics has not been clearly defined but would be a worthy research endeavour, especially if it could help motivate consumers to waste less.

Food literacy is defined as "the degree to which past experiences and acquired knowledge impact a consumer's food consumption and wastage practices" (Farr-Wharton et al. 2014). Being food literate means having skills and knowledge about food — its nutrition, how to prepare it, appropriate portion size and proper storage. Household waste is primarily generated by purchasing too much food, cooking/preparing food in excess, not using food before it spoils and a lack of confidence in the safety of using leftovers (CCFI 2018, NZWC 2017). Therefore, food literacy, or lack thereof, contributes to avoidable food waste (Gallant 2019b). Also directly tied to food literacy is consumer confusion regarding date codes on food products.

Food items have an array of date labels that cause consumers to be wary of buying or consuming products close to, or that have passed, "best before," "use by," "sell by" and "expiry" dates. When consumers misinterpret indicators of quality and freshness for indicators of a food's safety, this increases the amount of food unnecessarily discarded (Gooch et al. 2019; NZWC 2018; Leib et al. 2016; Wilson et al. 2015). Retailers also prematurely dispose of products nearing the date codes (Gunders 2012). In Canada, very few food products require expiry dates for safety (e.g., infant formula, meal replacements and nutritional supplements) (CFIA 2019). The federal government requires best-before labels on foods that will stay fresh for

[6] Canadians spend less on food than most of the 36 states in the Organization for Economic Co-operation and Development (OECD), whose members are considered developed countries. Canada is among the lowest eight countries in the world for household food expenditures. Source: *The Western Producer* (TWP) 2020.

fewer than 90 days and these dates are set at the manufacturer's discretion. Food products with a shelf life longer than 90 days are not required to have a date code but manufacturers are free to add them (CFIA 2019).

It is argued that manufacturers often implement "overly conservative" date labels to protect their brand, manage consumer perceptions of the product's quality and ultimately drive sales (Gooch et al. 2019; Nikkel et al. 2019). The result is unnecessary FLW as many of these same businesses "may not be prepared to donate food that is close to or slightly past its best before date for redistribution" (Gooch et al. 2019). Martin Gooch, CEO of VCMI and a leading expert on food waste, states: Throwing out food past its best before date even though it may still be perfectly edible is, "the largest single contributor to avoidable waste of all foods along the entire chain" (McGinn 2020). Lori Nikkel, CEO of Second Harvest, argues: "We need a behaviour shift" and that shift begins with better clarifying and understanding what food labels actually mean (McGinn 2020).

## THE NEED TO RECONSIDER THE FOOD SYSTEM'S EFFICIENCY

We may need to reconsider, or at least expand, the way we think of the food system's efficiency. Efficiency can be understood as the ability to achieve maximum productivity with minimum wasted effort or expense. There are conflicting views as to whether or not Canada's food system, as a whole, is truly efficient.

Efficiency as it relates to agriculture and the agri-food system has been primarily linked to economic objectives and meeting and/or exceeding market demands. For example, a House of Commons report (2018) argued that Canada's agricultural sector, as a whole, had become increasingly more "efficient" over two decades. The Standing Committee on Agriculture and Agri-Food based this measurement on balancing the sector's GHG emissions, which had remained relatively stable over the time period, with the increased productivity and "large contribution to Canada's economic growth." Conversely, MacRae et al. (2015) argue: "Contrary to the food system's efficiency rhetoric, it is actually highly inefficient from the perspective of resources consumed, pollution and food insecurity."

Increasing output as fast as possible has been linked to rising levels of food waste, which has generally been accepted as a cost of doing business (Thyberg and Tonjes 2016). The size of profit margins and the low cost of food waste disposal influence the amount of waste from manufacturing, retail and food service (Maguire 2016; Stuart 2009). It has been argued that businesses have not regarded FLW as a high priority because they have failed to adequately measure it and internalize the considerable impact on profitability (Uzea et al. 2014). However, in recent years, major retailers such as Walmart, Loblaw and Starbucks have begun to take steps to reduce their waste by donating surplus food, changing store policies and creatively marketing "ugly" produce. The fact that retailers have made changes to reduce food waste indicates they regard the decision to be good for business (Stuffco 2015). There are also many examples of companies across Canada creating

innovative and lucrative business opportunities using food that would otherwise be discarded. Some of the many examples are Bruized (Toronto, ON), SecondLife (Montreal, QC), Mt. Begbie Brewing Co. (Revelstoke, BC) and Outcast Foods (Halifax, NS) (Appendix A).

To argue that the food waste problem is complex would be an understatement. The discussion above is not an all-inclusive account of the multitude of contributing factors of FLW in Canada; rather, it highlights a few key themes in the dialogue.

Canada's food system is interconnected and FLW occurs at every level of the supply chain. FLW is the result of multiple and cumulative activities and the economic, social and environmental impacts are considerable.

One of the root causes of FLW is a culture of disposability and acceptance of waste (Gooch et al. 2019; von Massow 2019; Goodwin 2017; Strasser 1999). There has been a general disregard for FLW in the pursuit of maximizing output/economic growth, meeting market demands and keeping food prices low. Consumers are driving a huge amount of food waste not only in terms of what they discard but in their expectations of the food system; namely, esthetically perfect, convenient, abundant and cheap food. As Sylvain Charlebois (2020b), senior director of the Agri-Food Analytics Lab at Dalhousie University, argues, wasting food is "simply wrong, regardless of circumstances. Still, as consumers, we have the food industry we deserve. Our industry's architecture points to what consumers have wanted for decades, which is cheap food."

By all estimates, levels of FLW continue to rise and it is debatable how efficient our food system is if we are wasting resources unnecessarily and damaging the environment. Change will require a shift in thinking about how food and food waste are valued. Canada's food system is often taken for granted and waste is out of sight, out of mind. However, disruptions in the food supply chain caused by the COVID-19 pandemic have provoked public attention to FLW, which has in turn enabled dialogue and facilitated policy action.

## SECTION 2: COVID-19 DISRUPTIONS AS A CATALYST FOR ATTENTION ON FOOD SECURITY AND FLW

The COVID-19 pandemic has had a major global impact since late 2019. Since January 2020, when the first Canadian case was discovered, our nation has experienced major challenges to most facets of our society, including our food system.

Supply chain disruptions garnered media attention and Canadians became increasingly concerned about food security, both in terms of access and affordability (Holland 2020). Media reports of raw milk, produce and livestock being destroyed coincided with grocery store shortages and rising food bank demand. Consumers expressed confusion and outrage about why food was being wasted instead of given to food banks or to stock grocery stores. In fact, a May 2020

survey found that about half of consumers felt farmgate waste should be made illegal (AAL 2020b).

Destroying commodities at the farm level, as witnessed in spring 2020, is atypical and the scale reflective of a crisis situation. However, these events served as a catalyst for encouraging a public dialogue about Canada's food system and the important topics of food waste and food security.

Farmers make strategic decisions for their farm operations weeks and months in advance and dramatic shifts in market demands can be difficult to anticipate. The push for efficiency to ensure constant levels of supply means that many sectors operate just-in-time production. This means that if there is a breakdown at any point in the supply chain, food waste can occur because it cannot be easily or quickly redirected. Sudden shifts in market demand (domestic and international), transportation delays, labour shortages, processing plant slowdowns/closures, trade disputes, product recalls and weather and pest damage can all affect the supply chain.

In spring 2020, governments across Canada began to impose restrictions to mitigate the spread of COVID-19. Consumer consumption patterns rapidly changed as schools and restaurants closed and a number of meat-processing plants experienced virus outbreaks, temporarily shutting down and/or reducing capacity. These disruptions forced agricultural producers to make difficult production decisions, sometimes at great personal cost, to adjust to market demand.

Canada's food system has consistently proven its ability to quickly adapt and recover and it can be argued that over the last year it has once again proven its resiliency (Chenarides et al. 2021; Deaton 2021; McEwan et al. 2021; Rude 2021; Yeung and Kerr 2021; Pouliot 2020). Grocery stores remained open, shortages were quickly resolved within weeks and food prices, on average, only saw minimal increases — similar to what had been projected in December 2019 (Deaton 2021; AAL 2020a). In November 2020, the Canadian Centre for Food Integrity (CCFI) (2020) reported that 87 per cent of Canadians had confidence in Canada's food system but that 56 per cent worried about affordability.

In the past year, income loss from unemployment, reduced hours and businesses forced to close has exacerbated food insecurity among Canadians. Prior to the pandemic, an estimated 4.5 million Canadians were defined as "food insecure," meaning that they were unable to afford and/or access sufficient, safe and nutritious food (CFCC 2020; Tarasuk et al. 2016). It is estimated that since spring 2020, food insecurity among Canadians has increased by 39 per cent (CFCC 2020).

As the previous section discussed, there is an enormous amount of food loss and waste throughout the supply chain. Donating food is only one piece of the puzzle when it comes to ensuring more Canadians are food-secure and governments need to address root causes of food insecurity such as poverty and accessibility (Tarasuk

et al. 2016; Riches and Silvasti 2014; Socha et al. 2012). However, redirecting food that would otherwise be lost or wasted to those in need can help alleviate food insecurity and reduce avoidable FLW. Unfortunately, there are some key challenges to enabling diversion, including lack of infrastructure, co-ordination, misconceptions about food safety and liability and costs incurred.

Over the last year, public attention on food waste has largely been a result of news stories reporting food loss on farms. As mentioned, food discarded at the farm level is an important, but rather minimal, share of food that could be diverted. In fact, farmers and farm organizations are already some of the biggest contributors to food banks and community organizations. Food banks across Canada rely on partnerships with various agricultural sectors to receive large-scale donations of fresh food products (e.g., meat, dairy, eggs, produce). In 2020, many sectors increased their level of donation when food banks were able to accommodate surplus. Inadequate refrigeration and storage posed a huge barrier to donating food and preventing FLW (FBC 2020a). In addition, many food banks experienced a huge reduction in volunteers, which meant that distributing perishables before they spoiled also led to some food being sent to the landfill.

Co-ordinating food diversion is also commonly cited as a barrier to reducing FLW and donating it (FBC 2020b, 2016; Gooch et al. 2019). However, using technology, such as food rescue websites, social media platforms and apps that connect farmers/retailers and community organizations/consumers has been a promising development in recent years. For example, the Leftovers Foundation, one of Western Canada's largest food rescue charities, uses an app to facilitate food rescue and diversion. The Leftovers app "connects volunteers, who pick up good food destined for the landfill from grocers, bakeries and restaurants, and deliver it to service agencies" such as food banks (Spencer 2021). Leftovers estimates they redirect an average of 40,000 pounds of edible food each month in Alberta and Manitoba, which supports their dual mission to reduce food waste and increase food access (Spencer 2021; Leftovers 2020).

In the previous section, confusion over labelling was discussed as a key reason why food is often thrown out prematurely. Misconceptions around labels and liability also contribute to food ending up in landfills rather than distributed to citizens who are food insecure. As lawyer Mary Childs (2019) explains:

> Sometimes charities and donors worry about the risk that something may go wrong with donated food or that distributing food creates liability risks. Charities that receive donations of food approaching its "best before" date may be reluctant to pass it on to food banks or to put it into food hampers, fearing that to do so is unlawful or risky.

However, every province has legislation that protects citizens and businesses from liability when donating food or distributing donated food as long as the donation was given in good faith, meaning the donor believed it was safe and edible to

consume (i.e., not contaminated or spoiled). No reported court decisions in Canada have ever imposed liability on industry or individuals caused by donated food. However, there is undoubtedly a stigma to donating food past its best-before date that once again underlines the impact that labels have on FLW.

In addition to educating businesses and citizens about label information, food safety and liability, many food rescue advocates also have called on government to review how existing programs and policies are impacting diversion efforts, and what changes and/or new program measures could assist food rescue. Crop Insurance is a notable example that researchers identify as a program that often leads to unnecessary food waste as it prevents crops that have been claimed from being donated even if some of the crop is perfectly edible (Gooch et al. 2019).

The expense of processing, packaging and transporting can place a financial burden on donors in the supply chain, deterring them from donating surplus. Over the years, the National Zero Waste Council and Food Banks Canada have been among many that have called on government to offer a tax incentive to help facilitate more donations and prevent waste (FBC 2016; NZWC 2016). Currently, only four provinces (Ontario, Quebec, British Columbia and Nova Scotia) offer a tax credit to farmers for charitable donations and there are no federal or provincial tax incentives that apply to manufacturers, distributors or retailers. Given that these stages of the supply chain are where the majority of avoidable FLW occur, a tax incentive may be one policy measure governments could consider.

The extreme challenges of the last year have prompted a number of policies and programs related to food security and the diversion of surplus food. First announced in April and then augmented in October 2020, the Emergency Food Security Fund has provided $200 million to assist food banks and other food rescue organizations to purchase food and other basic necessities, buy and/or rent equipment, transport and distribute food, hire temporary help to fill volunteer shortages and implement biosecurity measures (AAFC 2021b). The federal government also launched the $50 million Surplus Food Rescue Program in June 2020 to save food loss at the farm level (AAFC 2020a). Within two months, over 12 million kilograms of food (e.g., eggs, potatoes, chickens, etc.) had been purchased from farmers and given to food banks and community organizations across Canada (Harris 2020).

Crisis can serve as a catalyst for change as it drives public attention towards issues that are often ignored. The past year has led many consumers to think about the food system they often take for granted and it has put a spotlight on issues often ignored such as food insecurity and FLW. The connection made between food security and FLW led to programming that helped divert surplus food to those in need. The following section will suggest further policy action that governments could take to reduce FLW.

## SECTION 3: STRENGTHENING CANADA'S FOOD SYSTEM BY REDUCING FLW: POLICY SUGGESTIONS

Food loss and waste transcends borders and jurisdiction. It is a policy issue for all levels of government and for various departments within governments (environment, agriculture, trade, health, etc.). To co-ordinate, find common objectives and commit resources to FLW initiatives has proven to be complicated (AAF 2017; Uzea et al. 2014; Gooch et al. 2010). Statistics indicate that rates of FLW are getting worse, which suggests that stakeholder action has so far been insufficient and/or unco-ordinated (Gooch 2016). In 2015, Canada, along with all other members of the United Nations, committed to a 50 per cent reduction per capita of food waste by 2030 (FAO 2021). To meet this goal, Canada will need a unified strategy and committed leadership.

Many factors contribute to driving levels of FLW. At the heart of the problem is how our society values food. Throughout the supply chain, from farmer to consumer, there is a culture of disregarding waste. Consumers and businesses fail to adequately measure and account for the costs of waste and FLW has become generally accepted and ignored. Government policies and programs have been overwhelmingly focused on economic development with little consideration for mitigating FLW. As part of a unified strategy to tackle the FLW problem, policy action should be directed at measurement, education, innovation and policy reform.

### ENHANCED MEASUREMENT

Enhanced measurement of FLW is necessary for informing a unified strategy and subsequent policy action. Governments, businesses and consumers have not fully measured and internalized the scale and related impacts of FLW. Calculating FLW's environmental and socio-economic impacts is essential to better understand where in the supply chain waste occurs and how policy actors can best target resources and programming to reduce it.

Data on FLW and its impacts will help to champion policy action and produce more measurable outcomes to motivate stakeholders. For example, measurements that can more effectively link food waste with food price dynamics, preventable costs for businesses and budgetary savings for governments would be useful for drawing a clear line from actions that prevent waste and the benefits that result. Moreover, it is essential that more accurate measurements are compiled to better inform investment and policy evaluation and to gauge progress.

Facilitating enhanced measurement will require a standard methodology and should incentivize sources to be as transparent and accurate as possible in their estimations. Data needs to be collected, compiled and analyzed more frequently. It is also critical to share data among stakeholders. For example, many municipal governments and businesses across Canada, to varying degrees, have implemented

policies and committed to reducing and/or redirecting food waste. Sharing this data, compiling information and examining best practices would be beneficial.

## EDUCATION

To incite cultural changes in how Canadians value food and disregard waste will not be an easy task. Education is essential to bring awareness, inform stakeholders and change behaviours. A survey conducted by the Canadian Centre for Food Integrity (2019) found that 91 per cent of Canadians know little or nothing about farming or the food system. Molly Gallant (2019), a food waste researcher, argues: "The logic is clear, if consumers have a greater understanding of how food choices impact their health, environment and bank accounts, they would likely waste less food."

While a number of factors motivate consumer behaviour (convenience, household demographics, health, etc.), food affordability is repeatedly cited as the foremost concern. As mentioned, more research into food price dynamics and helping consumers better understand the household expense of waste may encourage change. However, educating consumers about the costs of food waste needs to be accompanied by information that empowers Canadians to make better choices.

Meal planning and food literacy (preparing, using leftovers and storing food) could be promoted through apps, social media, labelling requirements and in retail stores. There are also encouraging examples in pop culture that may foster consumer change, including cooking shows that challenge contestants to use leftovers or random ingredients; IKEA's (2021) highly marketed *The Scrapsbook*, which promotes creativity with food scraps; viral videos of food rescue; and the trendiness of "ugly food" on social media, among others. These examples are notable because they provide information but also help to change the perception of food to prevent waste.

School programs that teach students about agriculture and the food system build the foundation for educated consumers and mindful citizens. A recent survey found 91 per cent of Canadians support teaching food literacy in schools (AAL 2021). The agricultural industry has made significant contributions to our nation's development and continues to serve multiple economic, social and environmental roles. As the farm population continues to decline, it is increasingly important that children better understand their relationship to the food system. Planting seeds and watching them grow, touring a farm, tracking the journey of food from farm to table and learning about different careers in agriculture all help build a foundation for educated consumers and mindful citizens. Agriculture in the Classroom Canada (AITC-C) is a charitable organization that provides educational programming to K–12 schools across Canada "to engage, connect, and inspire a deeper connection to agriculture" (AITC-C 2021). In partnership with their provincial affiliates, AITC-C provides instructional resources on topics such as sustainability, the contributions of the agricultural industry, food safety, healthy food choices and career opportunities, among others. In addition, AITC-C aims to build partnerships between classrooms and industry

stakeholders by arranging guest speakers and visits (in-person and virtual) to local farms. Policymakers should continue to invest in and promote these programs.

## INVESTING IN INNOVATION

The evolution of Canadian agriculture and the agri-food system has been enabled by applied science, technology and innovation in solving problems and finding better management practices. Innovative ideas and research will be key to finding improved methods in the supply chain to ensure greater efficiency and less resource waste.

In June 2019, the Canadian government announced the Food Policy for Canada, which cites reducing food waste as one of four key action areas. Programs and funding announcements reflect the government's aim to find innovative solutions to reduce FLW. Agriculture and Agri-Food Minister Marie-Claude Bibeau states: "Our government wants to reduce food waste and we are counting on our entrepreneurs to help us get there" (AAFC 2021c).

In 2020, the federal government committed $20 million to the Food Waste Reduction Challenge (FWRC), a competition that will award innovative ideas that provide solutions to prevent or reduce food waste at any point from farm to plate (AAFC 2020b; Fraser 2020). The first stage of the competition (Streams A and B) received 343 applications and winners have yet to be announced. Steams C and D of the FWRC were announced in spring 2021 (AAFC 2021c). In addition, the federal government created the AgriInnovate loan program. AgriInnovate "provides repayable contributions for projects that aim to accelerate the commercialization, adoption and/or demonstration of innovative products, technologies, processes or services that increase agri-sector competitiveness and sustainability" (AAFC 2021a). For example, in January 2021, Enterra Feed Corporation received $6 million to construct a facility in Rocky View County, Alberta, that diverts discarded produce from retail and food service to insect-based feed ingredients (AAFC 2021d).[7]

It will be essential that governments and businesses educate the public about the benefits and safety of new technology. For example, there is a great deal of stigma around genetically modified organisms (GMO). GMOs can help reduce unnecessary food waste at the farm level by minimizing crop loss from disease, weather and pests (CropLife Canada 2021; Friesen 2021; Brookes and Barfoot 2020; Hall 2016). In addition, GMOs can make commodities more resistant to bruising damage during transport and extend shelf life. Some examples of GMOs that are designed to prevent FLW include the Innate Potato, which is more resistant to bruising, and the Arctic Apple, which has a longer shelf life and does not oxidize when it is cut (Arctic Apples 2021; Simplot 2021). However, consumer understanding of various types of GMOs, slow consumer acceptance and regulatory delays have posed challenges

[7] Refer to Appendix A for additional information on Enterra.

(AAF 2017). An Angus Reid poll (2017) found that 28 per cent of Canadians regard GMO products as "generally unsafe" to eat and another 33 per cent were "unsure" about their safety. These statistics reveal that Canadians need more information to feel confident about GMO products and their potential benefits.

## POLICY REVIEW AND REFORM

To enable a cohesive and unified strategy to reduce FLW, government at all levels must review existing policies and programs that may be fostering FLW in the food system, some of which include grading standards, crop insurance programs, inexpensive disposal costs, labelling requirements, etc. Researchers have widely promoted changes to date coding on food products to reduce FLW (Gooch et al. 2019; NZWC 2018; AAF 2017; Leib et al. 2016). Standardizing date labelling is arguably "the most cost-effective solution for reducing food waste" (ReFed 2016). Requiring manufacturers to disclose how they calculated the best-before date, educating consumers on label terms and food safety and requiring storage information (e.g., freezing instructions), are all options government should consider.

Working to reduce FLW requires multiple stakeholders to take action. Motivations will vary and no one-size-fits-all policy approach will be effective. Involving stakeholders in the dialogue and understanding their concerns helps determine the best balance between rewards/incentives and punishments/restrictions. Research has indicated that incentives and voluntary agreements, especially at the manufacturing and retail stages, are favourable to promote change and compliance (AAF 2017; Gooch et al. 2016).

The federal government is in the best position to lead on a unified strategy for reducing FLW in Canada's food system. It is in line with the priorities they have espoused in the Food Policy for Canada and their commitment to the United Nations Sustainable Development goals (2015). In addition, the federal government has made an international commitment to reduce Canada's GHG emissions by 40–45 per cent by 2030 (Taylor 2021). With the considerable GHG emissions linked to FLW in landfills and throughout the entire food system, devoting more resources to reducing FLW would be a worthy investment for government.

The ultimate challenge for FLW policy review and development will be sustaining public and government attention. As Canada continues to deal with COVID-19's impacts, there will be competition for government resources and a push for economic recovery. Recent attention to FLW, especially as it relates to food security, has been helpful in pushing the issue onto the government's agenda but disruptions in the food system have been mostly resolved and it is questionable whether public attention can be effectively sustained.

The evolution of Canada's food system is a reflection of governments' economic goals and consumer demand. Efficiency has been largely associated with meeting and/or exceeding market demands in the quickest and most cost-effective ways

possible. However, rising levels of FLW in the food system and the substantial economic, social and environmental impacts tied to it weaken the claim that our food system is highly efficient. Reducing avoidable FLW through policy measures that prevent FLW and divert it when necessary would ultimately strengthen our food system by wasting fewer resources, finding new economic opportunities, preventing environmental damage and alleviating food insecurity.

## APPENDIX A: EXAMPLES OF CANADIAN BUSINESSES DIVERTING FOOD THAT WOULD OTHERWISE BE WASTED

### Bruized (Toronto, ON)

Bruized upcycles imperfect produce destined to be thrown out, into healthy plant-based products. Some of the products they offer include fruit compotes, chutneys and dehydrated fruit/granola.

https://www.bruized.com/

### SecondLife (Montreal, QC)

SecondLife sells boxes filled with a variety of healthy and fresh produce that was considered "out of standard"/ "uglies" and/or fruits and vegetables recovered from retail surpluses.

https://second-life.ca/about-us

### Mt. Begbie Brewing Co. (Revelstoke, BC)

In 2018, this brewery created a beer called "Our Daily Bread." It was brewed with bread that was originally destined for the landfill and supplied by the Food Connect program, Revelstoke's food recovery program. Part of the proceeds from the beer was donated to the food bank.

https://www.mt-begbie.com/

### Outcast Foods (Halifax, NS)

Outcast is a sustainable food tech company that takes "unsellable" misfit produce and upcycles it to create dried whole food protein powders and nutritional supplements.

https://outcastfoods.us/

### Enterra (Maple Ridge, BC and Rocky View, AB)

Enterra is based at Maple Ridge, BC and opened a second plant in Rocky View, AB in 2020. The company uses recycled food waste from local farms, grocery stores and food production facilities to feed black soldier flies, which are then dried and processed into animal feed ingredients and fertilizer for plants. At its Alberta facility, Enterra is able to recycle more than 130 tonnes of food waste per day.

https://enterra.com/

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