



THE SCHOOL OF PUBLIC POLICY

MASTER OF PUBLIC POLICY CAPSTONE PROJECT

Addressing the Externalities of Food Waste Generated Within the Retail Food Market

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Executive Summary

An oversupply of food within the retail food market has led to high levels of food waste which generates various negative externalities. These externalities include the release of harmful greenhouse gasses, the foregone opportunity to divert food, and foregone cost savings to retailers. Thus, this paper explores the effectiveness of various public policy responses to the market-based incentives that are resulting in food waste within the retail food market.

There is a current global trend towards government involvement in reducing food waste. However, Canada's existing regulations and guidelines simply aim to encourage retailers to donate excess food rather than directly regulate food waste. Conversely, local government efforts have focused mainly on reducing landfill use through compost and diversion programs. As a result, present food waste initiatives throughout Canada consist of a patchwork of policies and programs, while the appropriate role of government has remained relatively unexplored.

In addition to disorganized initiatives, food waste policy in Canada has centered on influencing consumer behaviour rather than retailer behaviour. However, the retail food market is an important piece of the food supply chain that creates avoidable food waste. Although, current research indicates that numerous challenges exist for reducing food waste within the retail food market, it is essential that this sector is included in a comprehensive food waste reduction program. Thus, policy-makers are faced with the challenge of developing an appropriate policy response to the growing levels of food waste specifically within the retail food market.

This paper uses a model of supply and demand to develop a conceptual model in order to explain why there is an oversupply of food within the retail food market and discuss the various policy responses governments can use to combat this waste. The policies explored include a tax on food waste, a subsidy to encourage the donation of food, and educational policy. The model demonstrates that retailers choose to maintain fully stocked shelves in order to receive a higher price from consumers, which results in food waste. Therefore, to reduce food waste in the retail food market, policy-makers must aim to increase the cost for retailers to maintain fully stocked shelves until the cost outweighs the benefit. Thus, while a subsidy and education can encourage the diversion and reduction of food waste, a tax is the most effective policy response to food waste because it forces retailers to internalize the cost of the negative externalities of food waste.

Introduction

History of Food Waste

Throughout history, food has been regarded as a symbol of power and affluence.¹ “Waste tends to be an indicator of economic success – the more prosperous society becomes, the more waste we generate” and, as a result, excess food has regularly been wasted by humans in various forms.² The relationship between food and prosperity holds true today with growing levels of unnecessary food waste in developed countries when compared to less developed countries.³ A pattern within countries in Europe and North America has been to encourage and fund research that results in a greater output of food products.⁴ Moreover, unsustainable consumption behaviour has driven food waste amongst developed countries resulting in more edible food entering landfills over time.⁵ Thus, there has been an increase in the production and resulting supply of food worldwide. Vaclav Smil highlights the root issue of food waste when he writes “its prevalence throughout the entire food system and its extent are truly astonishing, its perpetuation is among the most offensive demonstrations of human irrationality, and its

¹ Felicitas Schneider, “The History of Food Wastage,” (Institute of Waste Management, BOKU-University of Natural Resources and Life Sciences), accessed March 15, 2017, 10, http://www.ewmce.com/Resources/Documents/Felicitas_Schneider_-_The_History_of_Food_Wastage.pdf.

² Ministry of Environment and Parks, “Too Good to Waste,” (Government of Alberta, last modified July 21, 2015), 5, <http://aep.alberta.ca/waste/too-good-to-waste.aspx>.

³ Effie Papargyropoulou et al., “The Food Waste Hierarchy as a Framework for the Management of Food Surplus and Food Waste,” *Journal of Cleaner Production*, 76 (August 1, 2014): 108, doi:10.1016/j.jclepro.2014.04.020.

⁴ Vaclav Smil, “Improving Efficiency and Reducing Waste in Our Food System,” *Environmental Sciences* 1, no. 1 (2004): 25, <http://www.tandfonline.com/doi/pdf/10.1076/evms.1.1.17.23766?needAccess=true>.

⁵ Jenny Gustavsson, et al., “Global Food Losses and Food Waste: Extent Causes and Prevention,” (Food and Agriculture Organization of the United Nations, 2011), 4, <http://www.fao.org/docrep/014/mb060e/mb060e00.pdf>.

reduction would obviously go a long way toward improving the productivity of the modern food system while reducing its environmental impacts”.⁶ Although food waste is a small piece of the overall waste prevention framework, it is an important problem that must be addressed as the level of food entering landfills continues to grow.

Growing awareness

Global awareness of food waste has slowly developed over the past 40 years. The Food and Agriculture Organization (FAO), an agency of the United Nations, was established in 1945 and held the first World Food Conference in 1974.⁷ Since inception, the FAO has played an important role in documenting, quantifying, and attempting to address food waste. In addition to the work done by the FAO, the Organisation for Economic Co-operation and Development (OECD) is actively involved in the effort to prevent global waste levels from growing by developing an inventory that maintains the policies and practices used to address waste by member countries.⁸ Although not specifically focused on food waste, this program, initiated in 1994, led to the development of the OECD Reference Manual Working Party on Pollution Prevention and Control: Strategic Waste Prevention in 2000.⁹

⁶ Vaclav Smil, “Improving Efficiency and Reducing Waste,” 18.

⁷ Julian Parfitt, Mark Barthel, and Sarah Macnaughton, “Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050,” *Philosophical Transactions of the Royal Society of London B: Biological Sciences* 365, no. 1554 (September 27, 2010): 3066, doi:10.1098/rstb.2010.0126.; Corporate Services, Human Resources, and Finance Department, “World Food and Agriculture Situation,” (Food and Agriculture Organization of the United Nations), accessed June 3, 2017, <http://www.fao.org/docrep/meeting/007/F5340E/F5340E03.htm>.

⁸ “Working Party on Pollution Prevention and Control – Strategic Waste Prevention: OECD Reference Manual,” (OECD, August 2000), 3, [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?doclanguage=en&cote=env/epoc/ppc\(2000\)5/final](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?doclanguage=en&cote=env/epoc/ppc(2000)5/final).

⁹ Ibid.

Within the manual, the OECD reported that “from an overview of the current waste challenge... it is apparent that existing efforts going into waste prevention have not been sufficient in counter-acting the absolute growth in waste generation and associated hazards and risks. The urgency of waste prevention appears stronger than ever.”¹⁰ Consequently, ten years after release of the manual, the FAO estimated that approximately 15 percent of food is lost after the post-harvest stage and that this number only continues to grow.¹¹ These disconcerting patterns of growth in food waste, despite a growing awareness, has led researchers to question what drives this behaviour and to study what is the appropriate policy response to address this issue.

Project Scope

Market-driven incentives, as well as values and beliefs ingrained in the organizational structure within the retail food market, are pushing store managers to maintain a level of food on their shelves that results in a large amount of food being wasted. Often this food is still edible but does not meet the criteria of consumers with specific expectations of a product. Authors of an OECD study on waste write, “while experience and analysis give some indication of the relative effectiveness of different types of policies for influencing household and private sector decision-making, less has been learned about effective targeting of policies to different actors in the production and consumption chain.”¹² This statement identifies a gap in the research regarding the alternative policies that target waste outside of consumer behaviour and private

¹⁰ Ibid., 35.

¹¹ Julian Parfitt, Mark Barthel, and Sarah Macnaughton, “Food Waste within Food Supply Chains.”

¹² “Towards Sustainable Household Consumption: Trends and Policies in OECD Countries,” (OECD, 2002), 11, <https://www.oecd.org/env/consumption-innovation/1938984.pdf>.

sector decision making, such as the role of government. In response to this gap it is important to investigate why this waste is occurring and examine different methods to decrease the amount of food entering landfills.

Studies range in how to appropriately address the issue of food waste. The food supply chain ranges from the original production to the consumption of food, with various stages in between. As a result, several policy instruments can be used to influence food waste behaviour. These policies include economic, regulatory, and social instruments as well as other tools such as incentives for research, environmental assessments, and goal setting.¹³

Some propose that policy must focus solely on the consumer side of food waste and address the consumption patterns within households.¹⁴ However, the goal of this policy response is to reduce food waste entering landfills, rather than target food waste. For example, local governments may choose to implement an indirect strategy to reduce food waste entering landfills by forcing household to compost food waste, often known as green cart programs. While this policy may reduce the amount of food waste entering landfills, it is not specifically decreasing the current oversupply of food in retail stores that results in waste. Thus, it is important to clarify that reducing food waste certainly reduces landfill use, but reducing landfill use does not necessarily mean reducing food waste. When developing a policy response to food waste, policy-makers must be aware of whether the main objective is to directly reduce food waste through strict regulation or indirectly by targeting landfill use.

¹³ Ibid., 8.

¹⁴ Ibid., 1.

Food waste diverted from grocery stores, farmers markets, and the food processing industry is largely pure waste that can be safely diverted.¹⁵ Therefore, an opportunity exists to develop policy that encourages the diversion of the pure food waste generated within these sectors away from landfills. While this is a positive step in addressing food waste, governments must consider how to change retailer habits, such as over stocking shelves and poor management, which perpetuate food waste. Thus, this paper will discuss various policy responses to market-based incentives that result in food waste and explore the most appropriate response that directly aims to alter retailer behaviour that results in an oversupply of food.

Definition of Food Waste

Various definitions of food waste exist within the literature and debate centres around what truly constitutes food waste.¹⁶ For example, does food waste include only edible food that is sent to landfills and lost during the stages of the supply chain? Or should the definition expand to include food that is not edible and discarded, such as food damaged along the supply chain?¹⁷ Gooch et al. writes “stated in simple terms, food waste is the loss of food along the value chain that is suitable for human consumption, or will be fit for consumption after

¹⁵ James Levis et al., “Assessment of the State of Food Waste Treatment in the United States and Canada,” *Waste Management* 30, no. 8/9 (August 2010): 1493, doi: 10.1016/j.wasman.2010.01.031.

¹⁶ “Working Party on Agricultural Policies and Markets - Preventing Food Waste: Case Studies of Japan and the United Kingdom,” (OECD, December 2014), 26, [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/CA/APM/WP\(2014\)25/FINAL&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/CA/APM/WP(2014)25/FINAL&docLanguage=En).

¹⁷ Business and Industry Advisory Committee to the OECD, “BIAC Perspectives on Private Sector Solutions to Food Waste and Loss,” (OECD, June 2013), 2-3, <https://www.oecd.org/site/agrfcn/BIAC%20Perspectives%20on%20Private%20Sector%20Solutions%20to%20Food%20Waste%20and%20Loss.pdf>.

processing.”¹⁸ For simplicity, this definition of food waste will be used to qualify food waste throughout this paper.

Food waste is a product of a surplus in the supply of food being produced, “beyond our nutritional needs.”¹⁹ For food to be consumed there must be a supply chain that moves food from the producer to the consumer. The authors of *Developing an Industry Led Approach to Food Waste in Canada* explain the difference between food loss and food waste when they write, “food loss is due mainly to process-based factors, while food waste is caused mainly by decision-based factors.”²⁰ Thus, a certain level of food loss is unavoidable because, in order to reach the consumer, food must move along a supply chain and will be lost or damaged along the way.²¹ However, food waste is a result of poor decision-making and inefficient management along the supply chain.²² Thus, policy-makers are faced with the challenge of how to influence decision-making within the supply chain that results specifically in food waste, rather than food loss.

Background - The State of Food Waste Policy in Canada

Federal

According to the Government of Canada “The Canadian food system includes all the products produced and the processes and activities carried out to put food on the tables at home, in

¹⁸ Martin Gooch, Abdel Felfel, and Nicole Marenick, “Food Waste in Canada: Opportunities to Increase the Competitiveness of Canada’s Agri-food Sector, While Simultaneously Improving the Environment,” (Value Chain Management Centre International, November 2014), 8, <http://vcm-international.com/wp-content/uploads/2014/01/Food-Waste-in-Canada-November-2010.pdf>.

¹⁹ Effie Papargyropoulou et al., “The Food Waste Hierarchy as a Framework,” 112.

²⁰ Nicoleta Uzea, Martin Gooch, and David Sparling, “Developing an Industry Led Approach to Food Waste in Canada,” (Provision Coalition, 2013), 10, <http://nbs.net/wp-content/uploads/Addressing-Food-Waste-in-Canada.pdf>.

²¹ Ibid., 10.

²² Ibid., 10.

restaurants, and to provide foods for export.”²³ Thus, each step of the Canadian supply chain generates waste and must be taken into account when evaluating waste prevention policies. Currently, a nationally coordinated response to food waste in Canada does not exist and reduction initiatives vary based on province or territory.²⁴ While Statistics Canada collects information regarding waste disposal and waste diversion across Canada, there is no detailed data regarding the state of food waste by province and territory at the federal level. Majd Abdulla et al. write,

Canada, like the rest of the world, does not have the data required to empirically quantify food waste at each point in the food supply chain, from farmers to consumers. By understanding the magnitude of food waste at each point, policy makers are able to better evaluate the underlying causes of food waste in the Canadian food system and to consider the effectiveness of preventive tools.²⁵

Thus, it would be advantageous to collect national data on food waste in order to increase efficiency in the food supply chain at the retail level.

Provincial

Waste diversion falls under the jurisdiction of provinces and territories, resulting in a patchwork of food waste diversion strategies. Each province or territory may choose to record and quantify the level of food wasted within their jurisdiction. Consequently, some governments may choose to focus on the diversion of food waste while others do not. Governments that

²³ Statistics Canada, “Human Activity and the Environment: Section 1 Food in Canada,” (Government of Canada, last modified December 8, 2012), <http://www.statcan.gc.ca/pub/16-201-x/2009000/part-partie1-eng.htm>.

²⁴ Nicoleta Uzea, Martin Gooch, and David Sparling, “Developing an Industry Led Approach,” 15.

²⁵ Majd Abdulla et al., “The Importance of Quantifying Food Waste in Canada.,” *Journal of Agriculture, Food Systems & Community Development* 3, no. 2 (2012): 139, doi: 10.5304/jafscd.2013.032.018.

make waste diversion a priority have demonstrated success at decreasing their levels of waste.²⁶

In 2004, Alberta was the province with the highest rate of waste per capita.²⁷ In response, the Government of Alberta carried out a study which showed that municipalities were the third largest waste generating sector in the province, after the agricultural sector and oil and gas sector.²⁸ This study also found that from 1996 to 2004 the cost for municipal waste disposal in Alberta increased 79 percent from approximately \$100 million to over \$180 million per year.²⁹ The role of municipalities in waste generation and growing cost of waste disposal make waste diversion in cities a critical topic for future research.

While the Government of Alberta recognizes that the externalities produced by food waste are not reflected in the costs of handling municipal waste, the provincial governments' "waste management infrastructure consists primarily of facilities for collection of recyclables (approximately 4,000), waste disposal, and waste handling."³⁰ More recently, the Government of Alberta has focused efforts on developing effective waste management and diversion strategies using a waste management hierarchy. The goal of this strategy is to influence waste patterns and divert 80 percent of waste away from landfills.³¹ Currently, Alberta does not have

²⁶ Laurie Giroux, "State of Waste Management in Canada," (Giroux Environmental Consulting, April 2015), 105, http://www.ccme.ca/files/Resources/waste/wst_mgmt/State_Waste_Mgmt_in_Canada%20April%202015%20revised.pdf.

²⁷ Ministry of Environment and Parks, "Waste Facts," (Government of Alberta, 2008), 4, <http://aep.alberta.ca/waste/documents/WasteFacts-2007.pdf>.

²⁸ Ibid., 4.

²⁹ Ibid., 8.

³⁰ Ministry of Environment and Parks, "Too Good to Waste," 5.

³¹ Ibid., 5.

a provincial organics diversion strategy nor a ban on organics entering landfills.³² However, many municipalities have leaf and yard waste collection programs and some have organic waste composting.³³ In the past decade, the province has taken great strides towards developing more sustainable waste diversion strategies.

Municipal

The main policy response of local governments towards food waste entering municipal landfills has been indirect policy, such as composting and waste diversion programs. In 2000, the authors of the Strategic Waste Prevention OECD Reference Manual reported that,

OECD-wide recycling has been increasing, but without countervailing efforts toward waste prevention, a near-doubling of municipal waste within the OECD area is conceivable within the next 20 years. In general, it is unlikely that recycling by itself will be able to contend with the ever-mounting waste challenge.³⁴

While recycling has become more prominent as a waste diversion strategy, food and other “organic waste” are a growing concern that represent the largest source of municipal waste within participating OECD countries.³⁵ Furthermore, in the last 37 years, both waste and gross domestic product (GDP) within these countries have doubled.³⁶ Thus, the current challenge for municipalities is to develop innovative methods to decrease existing levels of waste and directly impact food waste at the source, found within the retail food market.

The City of Calgary has implemented several indirect policy responses in an effort to curb food waste. In 2007, the City of Calgary established a waste diversion strategy with the goal of

³² Laurie Giroux, “State of Waste Management,” 61.

³³ Ibid., 61.

³⁴ “Working Party on Pollution Prevention and Control,” 10.

³⁵ Ibid., 29.

³⁶ Ibid., 9.

diverting 80 percent of municipal waste by 2020, which was later revised to the goal of 70 percent by 2025.³⁷ In addition to waste diversion goals, the city launched a blue cart recycling program in 2009, a green cart organics composting program in 2010 for food and yard waste, and plans to open a compost facility in 2018.³⁸ Upon completion of each program, the city has expressed interest in exploring the possibility of a waste-to-energy plant, depending on the efficacy of these facilities in other pilot cities.³⁹ Furthermore, the City of Calgary implemented an increase in tipping fees from 2007 to 2011 in an effort to discourage landfill use.⁴⁰

In addition to city-led efforts, the Government of Alberta is aware of the important role of composting at the municipal level. Municipalities are able to compost organic materials and use the resulting compost in the city managed green spaces. However, a survey of municipalities in Alberta found that “over one third of municipalities regularly use compost but few have formal municipal council decisions or operational policies supporting these practices.”⁴¹ As a result, the Government of Alberta has identified composting as an area for future research.⁴²

The current waste policies are indirect and aimed mainly at consumers rather than retailers. These policies simply target landfill use, which may indirectly influence waste

³⁷ City of Calgary, “Leading Calgary to Zero Waste,” accessed March 20, 2017, <http://www.calgary.ca/UEP/WRS/Pages/About-WRS/Calgary-Waste-Goals.aspx>.

³⁸ Ibid.

³⁹ Ibid.; City of Calgary, “Green Cart Delivery Schedule,” accessed June 1, 2017, <http://www.calgary.ca/UEP/WRS/Pages/Recycling-information/Residential-services/Green-cart/Green-cart-delivery-schedule.aspx>.

⁴⁰ “The City of Calgary Industrial Commercial Institutional Waste Diversion Progress Update,” (City of Calgary, May 2011), 4, http://www.calgary.ca/UEP/WRS/Documents/WRS-Documents/UEP_ICI_Attachment_3.pdf?noredirect=1.

⁴¹ Ministry of Environment and Parks, “Composting Facilities,” (Government of Alberta, last modified March 23, 2016), <http://aep.alberta.ca/waste/waste-management-facilities/composting-facilities.aspx>.

⁴² Ibid.

behaviours but do not address the root cause of food waste within the retail food market.

While city-led efforts to reduce municipal food waste have been growing over the past several years, the city is not involved in direct efforts to decrease food waste within the retail food market. Policy-makers must consider whether local governments can play a more direct role in decreasing the amount of food being wasted.

Current Legislation and Regulation

Currently, federal regulations governing food donations and food waste in Canada do not exist. In 2016, Bill C-231, a private members bill, was introduced in parliament to establish the Federal Government's role in food waste. This Bill aimed to foster collaboration amongst provinces and territories as well as stakeholders within the food industry by implementing a national strategy for food waste.⁴³ Furthermore, the Bill recognized the importance of consumer education, enabling donation to local agencies, and setting goals for decreasing food waste.⁴⁴ However, the Bill was defeated after debate in parliament due to its close association with food insecurity.⁴⁵

Food donations guidelines are more commonly regulated by provincial and territorial authorities. In 2002, the province of Alberta enacted the *Charitable Donation of Food Act* that ensures any person or

⁴³ Bill C-231, *An Act to Establish National Food Waste Awareness Day and to Provide for the Development of a National Strategy to Reduce Food Waste in Canada*, 1st Sess, 42nd Parliament, 2015-2016, <http://www.parl.ca/DocumentViewer/en/42-1/bill/C-231/first-reading>.

⁴⁴ Ibid.

⁴⁵ "Bill C-231: Fight Against Food Waste," (OpenParliament.ca), accessed March 27, 2017, <https://openparliament.ca/bills/42-1/C-231/>.

director, office, agent, or employee of a corporation or organization or a volunteer who provides services or assistance to a corporation or organization that donates food or that distributes donated food is not personally liable for any damages resulting from injury or death caused by the consumption of the food.⁴⁶

As long as the food was donated without ill intent this Act encourages the donation of food to local agencies by providing protection to the business or individual that donates the food.

In addition to the *Charitable Donation of Food Act*, Alberta Health Services has created the AHS Guidelines for the Distribution of Donated Foods “these guidelines are intended for food facilities that distribute donated food to the public (i.e. food banks, soup kitchens, etc.).⁴⁷ This guideline outlines the proper steps to store, handle, and distribute food based on the “risk level” of the product. Together this framework and the *Charitable Food Donation Act* provide an important level of protection for businesses and individuals that donate food within Alberta. These regulations and guidelines encourage the donation of food but do not strictly regulate how much food is being wasted by retailers within Canada. Thus, only indirect policies exist regarding food waste within Canada. This lack of regulation allows retailers to continue waste at the same levels if they choose to do so.

Snapshot of Retail Food Waste

It is useful to understand the amount of waste generated to address the issue of food waste appropriately. From 2008 to 2014 the amount of waste, both residential and non-residential, in Canada remained relatively consistent with 25,926,476 tonnes of waste disposed in 2008

⁴⁶ *Charitable Donation of Food Act*, Revised Statutes of Alberta 2000, c. 8, 2017, <http://www.qp.alberta.ca/documents/Acts/C08.pdf>.

⁴⁷ Alberta Health Services, “Guidelines for the Distribution of Donated Food,” (Government of Alberta, January 2001), <http://rescuefood.ca/wp-content/uploads/2015/09/wf-eh-guide-distribution-donated-food.pdf>.

compared to 25,103,034 tonnes in 2014.⁴⁸ However, data specifically regarding food waste is not collected at the national level within Canada, making it a challenge to construct an accurate picture of the amount of food wasted within the retail food sector. The tables presented below provide a picture of the waste patterns and behaviours in Canada, Alberta, and Calgary.

Canada

Table 1 – Non-residential Waste Disposed in Canada 2006-2014

Year	2006	2008	2010	2012	2014
Non-Residential Waste Disposed (tonnes)	16,668,793	16,556,076	15,504,250	14,996,859	15,136,259

Source: CANSIM - 153-0041 - Disposal of waste, by source, Canada, provinces and territories

The table above shows the amount of non-residential waste (in tonnes) disposed of in Canada from 2006 to 2014. Overall in 2014 Canadians generated 15,136,259 tonnes of non-residential waste, an increase from 2012 that saw 14,996,859 tonnes of waste generated (see table above). Although the total amount of non-residential waste slightly decreased from 2006 until 2012, in 2014 Canada experienced an increase in non-residential waste for the first time since 2008.⁴⁹

Table 2 – Non-residential Waste Diverted in Canada 2006-2014

Year	2006	2008	2010	2012	2014
Non-Residential Waste Diverted (tonnes)	3,903,840	4,009,592	3,580,459	3,794,069	4,255,135

Source: CANSIM - 153-0042 - Materials diverted, by source, Canada, provinces and territories

⁴⁸ Canada, Statistics Canada, "Table 153-0041 - Disposal of waste, by source, Canada, provinces and territories, every 2 years (tonnes)," (Ottawa, last modified September 21, 2016), accessed June 10, 2017, <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1530041>.

⁴⁹ Canada, Statistics Canada, "Table 153-0041 - Disposal of waste, by source, Canada, provinces and territories, every 2 years (tonnes)," (Ottawa, last modified September 21, 2016), accessed June 10, 2017, <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1530041>.

The table above shows the amount of non-residential waste (in tonnes) diverted in Canada from 2006 to 2014. The amount of non-residential waste diverted has grown from 3,903,840 tonnes in 2006 to 4,255,135 in 2014. However, the table above indicates that although the overall amount of waste being diverted has grown, this growth has been relatively inconsistent for the past eight years.⁵⁰

Table 3 – Organic Materials Diverted in Canada (both residential and non-residential) 2006-2014

Year	2006	2008	2010	2012	2014
Organics Diverted (tonnes)	1,906,114	1,906,114	2,212,484	2,453,330	2,686,532

Source: CANSIM - 153-0043 - Materials diverted, by type, Canada, provinces and territories

The table above shows the amount of organic materials (in tonnes) diverted in Canada, both residential and non-residential, from 2006 to 2014. This table indicates that the level of organics diverted, which includes food products, has grown each year from 2006 to 2014 (see table below).⁵¹

While the Federal Government does not release statistics regarding the amount of food wasted nationally, the Value Chain Management published two studies, in 2010 and 2014, that examine the cost of food waste in Canada as well as where waste is generated and how to

⁵⁰ Canada, Statistics Canada, "Table 153-0042 - Materials diverted, by source, Canada, provinces and territories, every 2 years (tonnes)," (Ottawa, last modified March 23, 2017), accessed June 10, 2017, <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1530042>.

⁵¹ Canada, Statistics Canada, "Table 153-0043 - Materials diverted, by type, Canada, provinces and territories, every 2 years (tonnes)," (Ottawa, last modified March 24, 2017), accessed June 11, 2017, <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1530043>.

reduce this waste.⁵² These studies conclude that the cost of food waste in Canada has increased from \$27 billion to \$31 billion between 2010 and 2014.⁵³ These studies also found that in 2014, retail sector food waste made up 10 percent of all food waste.⁵⁴ It is important to clarify that, although some tables show that there has been an increase in the amount of waste being diverted, this does not equate an overall reduction in food waste. The tables simply demonstrate that there is less organic waste entering landfills but fails to provide an accurate picture of whether there is less food being wasted overall.

Alberta

Table 4 – Non-residential Waste Disposed in Alberta 2004-2008

Year	2004	2006	2008
Non-residential Waste Disposed (tonnes)	2,133,890	2,846,189	3,070,895

Source: Human Activity and the Environment: Detailed Statistics: Table 11.2 — Disposal of waste, by source and by province and territory

The table above shows the amount of non-residential waste (in tonnes) disposed of in Alberta from 2004 to 2008. As opposed to overall decrease in non-residential waste in Canada, Albertans have steadily increased their non-residential waste from 2004 to 2008 based upon

⁵² Gooch, Martin, Felfel, Abdel, and Marenick, Nicole, “Food Waste in Canada,”.; Gooch, Martin, and Felfel, Abdel. “\$27 Billion Revisited: The Cost of Canada’s Annual Food Waste.” Value Chain Management Centre International, December 10, 2014. <http://vcm-international.com/wp-content/uploads/2014/12/Food-Waste-in-Canada-27-Billion-Revisited-Dec-10-2014.pdf>.

⁵³ Ibid.

⁵⁴ Ibid., 11.

the most recent figures available.⁵⁵ In 2008 Albertans disposed of 3,070,895 tonnes of waste, and increase from 2,133,890 tonnes in 2004.⁵⁶

Table 5 – Disposal, Diversion, and Diversion Rate of Waste in Alberta (2004-2008)

Year	2004	2006	2008
Waste Disposed per capita (kilograms)	949.9	1,116.5	1,122.0
Waste Diverted per capita (kilograms)	191.4	190.8	202.9
Diversion Rate per capita (percent)	16.8	14.6	15.3

Source: Human Activity and the Environment: Detailed Statistics: Table 11.1 — Disposal and diversion of waste, by province and territory

The table above shows the waste disposed per capita (in kilograms), waste diverted per capita (in kilograms) and diversion rate per capita (in percent) from 2004 to 2008. This table indicates that while the waste diverted per capita grew in Alberta from 2004 to 2008, the waste disposed per capita also grew during this time (see table below). Thus, the diversion rate per capita in percent fell 1.5 percent from 2004 to 2008.⁵⁷

Calgary

Table 6 – Non-residential Waste Entering City of Calgary Landfills (2007 and 2010)

Year	2007	2010
Non-residential Waste in City of Calgary Landfills (tonnes)	552,000	436,000

Source: The City of Calgary Industrial Commercial Institutional Waste Diversion Progress Update

⁵⁵ Canada, Statistics Canada, "Table 153-0041 – Disposal of waste, by source and by province and territory," (Ottawa, last modified November 27, 2015), accessed June 11, 2017, <http://www.statcan.gc.ca/pub/16-201-s/2011001/t078-eng.htm>.

⁵⁶ Canada, Statistics Canada, "Table 153-0041 – Disposal of waste, by source and by province and territory," (Ottawa, last modified November 27, 2015), accessed June 11, 2017, <http://www.statcan.gc.ca/pub/16-201-s/2011001/t078-eng.htm>.

⁵⁷ Canada, Statistics Canada, "Tables 051-0001, 153-0041, and 153-0041 - Disposal and diversion of waste, by province and territory," (Ottawa, last modified November 27, 2015), accessed June 12, 2017, <http://www.statcan.gc.ca/pub/16-201-s/2011001/t077-eng.htm>.

The table above shows the amount of non-residential waste entering the City of Calgary landfills from 2007 to 2010 based on a 2010 report on industrial, commercial, and institutional waste (ICI) in Calgary. The authors of this report found that, from 2007 to 2010, the amount of non-residential waste in Calgary landfills decreased by 20 percent from 552,000 tonnes in 2007 to 436,000 tonnes in 2010 (see table below).⁵⁸ Moreover, this report estimated that ICI sectors accounted for 50 percent (314,500 tonnes) of the city's waste.⁵⁹ Both the retail trade and accommodation sector and the food service sector were amongst the top four generators of waste within the city.⁶⁰ Finally, the authors reported that food waste was the second most likely waste material to be found within the waste generated by the ICI sector, accounting for 26 percent of the waste stream.⁶¹

Literature Review

Impacts of Food Waste

There is consensus within the literature that food waste generates various negative externalities.⁶² According to the FAO,

food losses represent a waste of resources used in production such as land, water, energy and inputs. Producing food that will not be consumed leads to unnecessary CO2 emissions in addition to loss of economic value of the food produced.⁶³

⁵⁸ "The City of Calgary Industrial Commercial Institutional Waste," 3.

⁵⁹ *Ibid.*, 5.

⁶⁰ *Ibid.*, 5-6.

⁶¹ *Ibid.*, 6.

⁶² "Food Wastage Footprint: Impacts on Natural Resources Summary Report," (Food and Agriculture Organization of the United Nations, 2013), 8, <http://www.fao.org/docrep/018/i3347e/i3347e.pdf>.

⁶³ Jenny Gustavsson, et al., "Global Food Losses and Food Waste," 1.

Moreover, the FAO estimates that global food waste accounts for the third largest greenhouse gas emitter when compared to total greenhouse gas emissions in the top 20 greenhouse gas emitting countries worldwide.⁶⁴

The Food Waste Reduction Alliance (FWRA) suggests that there is an economic, environmental, and social incentive to decreasing food waste.⁶⁵ From an economic perspective, retailers can save money by addressing the large amount of food being wasted within their stores.⁶⁶ From a social perspective, food waste may be reduced by donating nutritious and edible food to local agencies instead of sending it to the landfill.⁶⁷ Finally, food that ends up in the landfill releases a harmful methane gas into the environment, thus, reducing the amount of food entering landfills will decrease the amount of gas being released.⁶⁸ The negative externalities generated by food waste indicate that governments have a role to play in Canadian food waste policy.

Waste Along the Food Supply Chain

Food waste occurs along the entire food supply chain creating a challenge for policy-makers to develop effective policy responses. The image below shows the sources of food waste across the entire supply chain which each generate varying levels of waste.⁶⁹

⁶⁴ “Food Wastage Footprint,” 17.

⁶⁵ Food Waste Reduction Alliance, “Volume 2: Best Practices and Emerging Solutions Guide,” (Food Marketing Institute, Grocery Manufacturers Association, and National Restaurants Association, 2015), 7-8, http://www.foodwastealliance.org/wp-content/uploads/2013/05/2015FWRAToolkit_Web_FINAL.pdf.

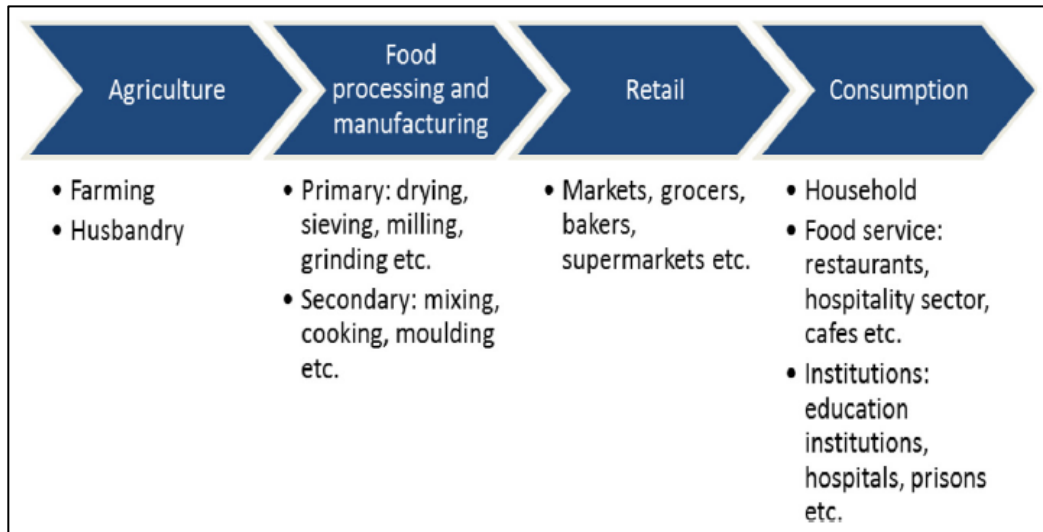
⁶⁶ Ibid., 7-8.

⁶⁷ Ibid., 7-8.

⁶⁸ Ibid., 7-8.

⁶⁹ Effie Papargyropoulou et al., “The Food Waste Hierarchy as a Framework,” 76.

Figure 1 – Sources of Food Waste within the Food Supply Chain



Source: Effie Papargyropoulou et al., “The Food Waste Hierarchy as a Framework for the Management of Food Surplus and Food Waste.”

Smil highlights the challenge of influencing food waste along the supply chain when he writes, “reduction of post-harvest losses requires, much like the conservation of energy in millions of homes, myriads of individual decisions and sustained, repeated actions and adjustments.”⁷⁰ Thus, actors along each stage of the supply chain can take steps and implement changes to decrease the level of waste within their sector. The distribution sector of the food supply chain refers to the piece of the supply chain after production and prior to consumption and focuses specifically on the “market system...e.g. wholesale markets, supermarkets, retailers and wet markets.”⁷¹ This paper centres on decisions made within the distribution portion of the food supply chain, specifically grocery stores and supermarkets referred to as the “retail” sector in the image above. The following section will explore the best practices for reducing the amount of food entering landfills from the retail food market identified within the literature.

⁷⁰ Vaclav Smil, “Improving Efficiency and Reducing Waste,” 20.

⁷¹ Jenny Gustavsson, et al., “Global Food Losses and Food Waste,” 2.

Best Practices Explored

Collective Action/Partnership

A successful food waste reduction campaign must encourage collective action and partnership amongst sectors. It is beneficial to establish a committee or organization focused solely on waste reduction initiatives. For example, WRAP, established in 2000 in the United Kingdom, is a large organization that partners with various sectors throughout the European Union to work towards sustainable growth.⁷² WRAP's "mission is to accelerate the move to a sustainable, resource-efficient economy by: re-inventing how we design, produce and sell products, re-thinking how we use and consume products, and re-defining what is possible through re-use and recycling."⁷³ Creating a separate entity that pools resources and partners with businesses lessens the burden to implement waste diversion policies and change existing management structures. Furthermore, it encourages the sharing of best practices and resources amongst all levels of businesses across sectors and provides smaller retailers with the resources and tools to decrease their food waste.

Education

Education is a crucial piece of a comprehensive food waste reduction strategy. The United Kingdom recognizes that government intervention is necessary to address food waste and, as a result, has focused efforts on increasing the knowledge of consumers and businesses to alter behaviours that perpetuate waste.⁷⁴ Another example of education being used to combat food waste is the Food Waste Reduction Alliance in the United States which published Volume 1 of

⁷² "Our History," (WRAP), accessed June 3, 2017, <http://www.wrap.org.uk/about-us/our-history>.

⁷³ "Our Vision," (WRAP), accessed June 3, 2017, <http://www.wrap.org.uk/about-us/about>.

⁷⁴ "Working Party on Agricultural Policies and Markets," 25.

the Best Practices & Emerging Solutions Toolkit in 2014, followed by Volume 2 in 2015.⁷⁵ The objective of this toolkit, which is available to both the public and private sectors, is to decrease the amount of food waste entering landfills, increase the donation of food to local food banks and quantify the amount of food being wasted.⁷⁶

In addition to education initiatives that target businesses and consumers with methods to decrease waste, retailers are often unaware of the positive savings that result from the implementation of improved waste management strategies.⁷⁷ To achieve these savings, managers within the retail food market can alter current practices when ordering products, set specific goals to decrease food waste, and donate unused edible food to local agencies in order to decrease the costs associated with food disposal.⁷⁸ Thus, a simple way to encourage retailers to reduce the amount of food waste generated within their stores is to inform them of their future cost savings that result from these changes.

Life-cycle Approach to Waste

A life-cycle approach identifies where waste is generated along the supply chain as products and materials are moved from producers to consumers. This approach allows governments to develop and adjust specific policies that target each piece of the supply chain based on what category of waste they intend to influence. The figure below shows the Life-cycle of Waste

⁷⁵ Food Waste Reduction Alliance, “Volume 1: Best Practices and Emerging Solutions Toolkit,” (Food Marketing Institute, Grocery Manufacturers Association, and National Restaurants Association, 2014), http://www.foodwastealliance.org/wp-content/uploads/2013/05/2014FWRAToolkit_Web_FINAL.pdf.; Food Waste Reduction Alliance, “Volume 2: Best Practices.”

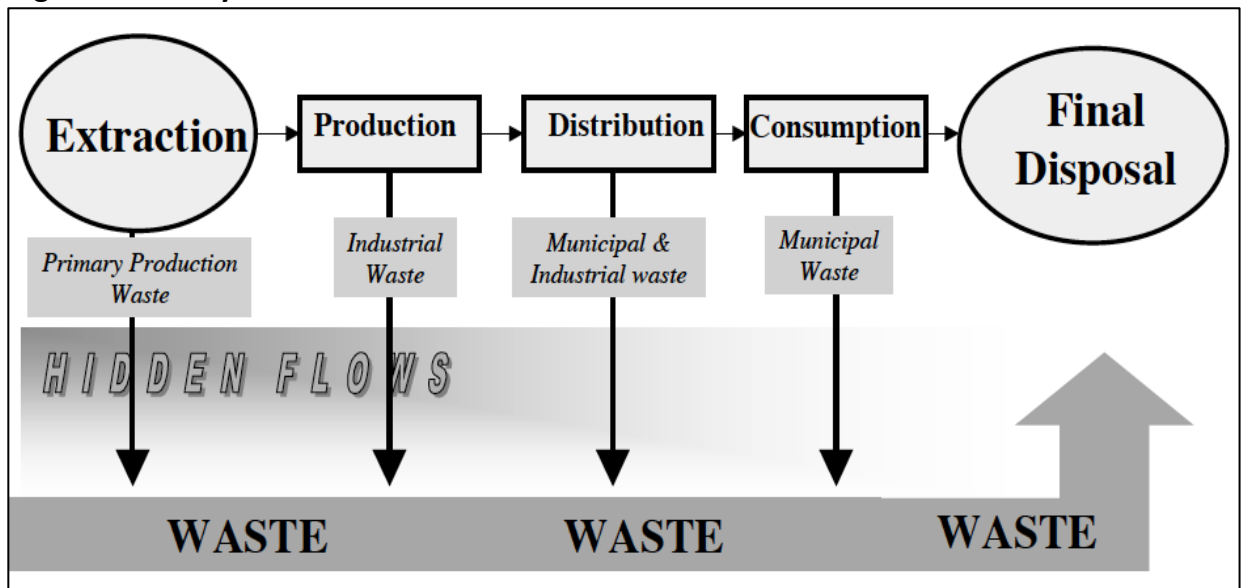
⁷⁶ Food Waste Reduction Alliance, “Volume 1: Best Practices,” 3-4.

⁷⁷ Nicoleta Uzea, Martin Gooch, and David Sparling, “Developing an Industry Led Approach,” 19-20.

⁷⁸ Business and Industry Advisory Committee to the OECD, “BIAC Perspectives on Private Sector Solutions,” 6-7.

Generation recommended within the OECD Reference Manual Working Party on Pollution Prevention and Control.⁷⁹ Within this figure, the distribution portion of the supply chain, which is the focus of this paper, generates mainly municipal and industrial waste. Consequently, because municipal waste has a large volume of food and organic waste, policy-makers can develop policy responses that specifically target this piece of the supply chain to decrease the amount food entering landfills. Using the life-cycle approach to address food waste is a potential area of development to target each step of the supply chain accordingly.⁸⁰

Figure 2 – Life-cycle of Waste Generation



Source: “Working Party on Pollution Prevention and Control – Strategic Waste Prevention: OECD Reference Manual.”

Waste Hierarchy

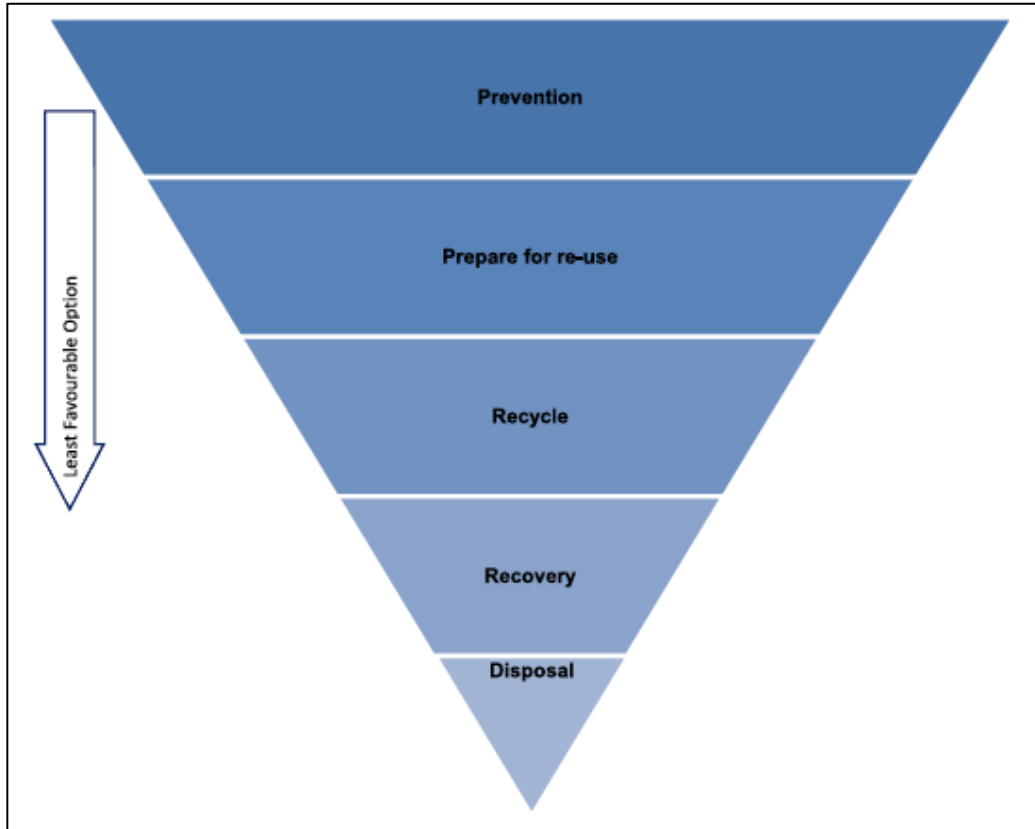
In addition to the life cycle-approach to waste, various waste hierarchy models exist within the literature. These models serve as a useful tool to visualize and develop waste

⁷⁹ “Working Party on Pollution Prevention and Control,” 29.

⁸⁰ Tara Garnett and Andreas Wilkes, “Appetite for Change: Social, Economic and Environmental Transformations in China’s Food System,” (Food Climate Research Network, February 2014), 5, http://www.fcrn.org.uk/sites/default/files/fcrn_china_mapping_study_final_pdf_2014.pdf.

diversion strategies. For example, in the figure below E. Papargyropoulou et al. propose a waste hierarchy that ranges from most to least favourable option listed in descending order starting with prevention and ending with disposal.⁸¹

Figure 3 – The Waste Hierarchy



Source: Effie Papargyropoulou et al., “The Food Waste Hierarchy as a Framework for the Management of Food Surplus and Food Waste.”

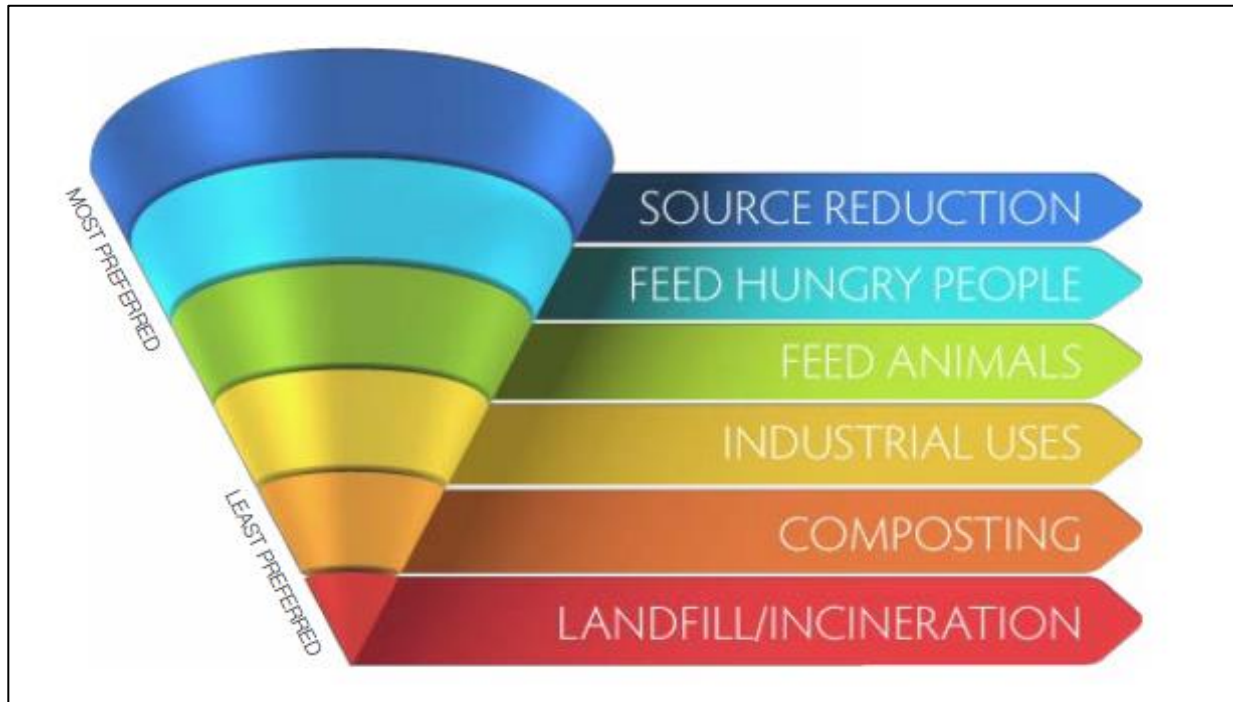
Likewise, the Food Waste Reduction Alliance recommends using the EPA Food Recovery Hierarchy that lists options for dealing specifically with food waste from most to least preferable. This model suggests the following steps in descending order: source reduction, feeding hungry people, feeding animals, industrial uses, composting, and landfill/incineration as methods for decreasing the amount of food waste entering landfills.⁸² The EPA’s model is highly

⁸¹ Effie Papargyropoulou et al., “The Food Waste Hierarchy as a Framework,” 76.

⁸² Food Waste Reduction Alliance, “Volume 2: Best Practices,” 11.

targeted towards food waste and helps businesses understand more desirable waste options depending on the state of the food and encourages them to develop management techniques based on these options.

Figure 4 – EPA Food Recovery Hierarchy



Source: Food Waste Reduction Alliance, “Volume 2: Best Practices and Emerging Solutions Guide.”

Diverting Food to “Feed Hungry People”

It is important to discuss the tension that exists between best practices in food waste diversion and the literature that exists regarding food insecurity. “Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe, healthy and nutritious food to meet their dietary needs and food preferences for an active and healthy life.”⁸³ Thus,

⁸³ The Calgary Food Committee and Serecon Management Consulting Inc., “Calgary Eats! Summary: A Food System Assessment and Action Plan for Calgary,” (The City of Calgary, May 29, 2012), 18, <https://www.calgary.ca/CA/cmo/Documents/CalgaryEATS!%20SUMMARY%20Food%20System%20Assesment%20%20Action%20Plan%20for%20Calgary%20May2012.pdf?noredirect=1>.

when an individual does not have access to “sufficient, safe, healthy and nutritious food” they are considered food insecure. Within the literature on food waste there is often a connection drawn between the excessive amounts of food being wasted and the number of individuals and families who are food insecure within a given country. Furthermore, the second step of the EPA’s waste recovery hierarchy recommends diverting food to hungry people to stop it from entering landfills.⁸⁴ However, debate exists over the suitability of linking food waste with food insecurity due to the policy responses that are generated when these two issues are paired together.

During debate in Parliament concerning Bill C-231, *An Act to establish National Food Waste Awareness Day and to Provide for the Development of a National Strategy to Reduce Food Waste in Canada*, Liberal MP Julie Dabrusin explained the tension between food insecurity and food waste when she stated, “there is also a larger problem with the bill. That is the fact that a link has been drawn between food waste and food insecurity. Food insecurity is due to poverty. It is not about the availability of food.”⁸⁵ Dr. Lynn McIntyre’s work, *A Great or Heinous Idea?: Why Food Waste Diversion Renders Policy Discussants Apoplectic*, echoes these sentiments when she explains that the debate concerning the morality of diverting food to hungry people centres around two distinct perspectives: the humanist perspective versus the ecological perspective.⁸⁶ While both view food insecurity as problem within society, each perspective takes a different stance on how to appropriately address the issue. The ecological

⁸⁴ Food Waste Reduction Alliance, “Volume 2: Best Practices,” 11.

⁸⁵ “Bill C-231: Fight Against Food Waste.”

⁸⁶ Lynn McIntyre, Patrick B. Patterson, Laura C. Anderson & Catherine L. Mah, “A Great or Heinous Idea?: Why Food Waste Diversion Renders Policy Discussants Apoplectic,” *Critical Public Health*, (November 17, 2016):2-3, doi: 10.1080/09581596.2016.1258455.

perspective take a systems approach, rather than strictly individual, and assumes that harmful actions that damage the ecosystem will have negative impacts on health.⁸⁷ Thus, theorists in this camp aim to explore the role of government in incentivizing action that reduces these negative actions to increase community well-being. The Humanistic perspective is focused on the individual and considers individual well-being as the measurement of well-being within the community. Thus, this perspective aims to deliver government policy that attempts to “improve human welfare, values, and dignity” and maximizes “human health and welfare”.⁸⁸

This paper recognizes that food policy in Canada is a complicated debate that has failed to result in policy that truly addresses the issue of food insecurity nationwide.⁸⁹ Food insecurity is a separate and important policy issue that cannot be appropriately addressed through food waste policy. However, from an ecological and sustainable resource management perspective, the level of food entering landfills is harmful to the environment and has negative impacts on well-being of the ecosystem. Consequently, this paper acknowledges the EPA’s waste diversion hierarchy as an efficient method to decrease the level of food waste entering landfills and reduce the negative impacts it has on the environment. However, this paper also recognizes that food diversion is an indirect response to the issue of food waste. Therefore, the paper will explore a direct policy response that governments can implement to decrease the level of food being wasted within the retail food market.

⁸⁷ Ibid., 2-3.

⁸⁸ Ibid., 2-3.

⁸⁹ Catherine L. Mah et al., “A Frame-Critical Policy Analysis of Canada’s Response to the World Food Summit 1998–2008,” *Archives of Public Health* 72 (2014): 1-41, doi:10.1186/2049-3258-72-41.

Case Studies

As the body of research has grown, some countries have begun to implement policies that specifically target food waste. These policies, which range from voluntary initiatives to strict regulation, fall into three distinct categories of government intervention. The three categories include education/voluntary initiatives, such as government funded education campaigns and organizations that collect and disseminate resources, market-based policies, such as subsidies or tax credits when donating food to local agencies, and command-and-control policies such as regulations banning organics from landfills, taxes on food waste and laws requiring retailers to donate edible food that would otherwise be wasted.

In an effort to reduce food waste, both the United Kingdom and Denmark have implemented voluntary initiatives. The United Kingdom encourages distributors in the retail sector to utilize best practices in order to reduce their waste by disseminating resources and information, while Denmark's campaign focuses on consumer shopping behaviours and education.⁹⁰ Contrary to voluntary and education initiatives, France, in 2015, passed a law that requires supermarkets of a certain size to sign an agreement with a local charity to donate edible food that would otherwise be wasted.⁹¹ In addition to the law, French policy-makers moved forward with 6 proposals to combat food waste as a nation.⁹² Italy also passed a law with a goal to decrease food waste nationwide by 20 percent that will focus on consumer

⁹⁰ Jenny Gustavsson, et al., "Global Food Losses and Food Waste," 14.

⁹¹ Peter Rixon, "France Passes Food Waste Law," (EU Food Law, May 22, 2015), <http://www.eurofoodlaw.com/policy/environment/waste-management/france-passes-food-waste-law-108930.htm?origin=internalSearch>.

⁹² Marie Mourad, "France Moves Towards a National Policy Against Food Waste," (NRDC, September 2015), 4, <https://www.nrdc.org/sites/default/files/france-food-waste-policy-report.pdf>.

behaviour and clarify the liability of businesses who donate food.⁹³ Furthermore, Scotland, in addition to strict regulations requiring businesses to separate food waste from other waste, plans to implement a ban on “biodegradable municipal waste” from entering landfills by 2021.⁹⁴ These are just some examples of the various food waste policies being implemented by governments worldwide. However, despite strides in the effort to reduce global food waste, significant challenges exist. The following section will outline the barriers to addressing food waste within the retail food market.

Challenges to Addressing Food Waste in the Retail Sector

Values and Beliefs

Supply issues and consumer demands perpetuate the belief that there must be a constant supply of products within grocery stores while gaps on shelves signal poor management. As a result, managers order larger than necessary quantities of each product in order to maintain the volume on their shelves, and this results in an oversupply of food that ends up in landfills. Food waste is driven by the values and beliefs ingrained within the organizational structure of each business as well as pressure on store managers to purchase a range of products from the same supplier to access lower costs for products.⁹⁵ For example, in the United Kingdom, the organization WRAP found that market power was occurring between the suppliers of food

⁹³ Paul Hutchinson, “Italy Adopts New Law to Cut One Million Tonnes of Food Waste,” (EU Food Law, August 9, 2016), <http://www.eurofoodlaw.com/policy/italy-adopts-national-law-to-cut-one-million-tonnes-of-food-waste-118770.htm?origin=internalSearch>.

⁹⁴ Scotland Government, “Zero Waste,” (Scottish Environmental Protection Agency), accessed June 1, 2017, <https://www.sepa.org.uk/environment/waste/zero-waste/>.

⁹⁵ Jenny Gustavsson, et al., “Global Food Losses and Food Waste,” 13.

products and retailers and, as a result, retailers were forced to oversupply the products within their store to remain competitive in the local retail market.⁹⁶

In addition to local competition, there is also a degree of uncertainty when ordering food products that must travel long distances which results in the “over-ordering” of food products. Consumers’ hold expectations that “a wide variety of products” will be available in stores and there is a general belief that consumers will not buy products that do not meet their standards regarding look and feel.⁹⁷ Thus, if retailers order a smaller amount of products they risk receiving products that do not meet consumer standards and having partially stocked shelves that do not appeal to consumers. A report titled, *Addressing Food Waste in Canada*, found that “the pioneers in proactively reducing food waste... tend to be larger businesses that incur higher disposal fees, are more sophisticated in their management systems, have more resources, and are driven by broader corporate social responsibility (CSR) mandates.”⁹⁸ Thus, businesses with social responsibility ingrained within their policies and that have access to more resources are more likely to implement food waste diversion practices, posing a challenge to policy-makers that aim to reduce food waste within the entire retail food sector.

Lack of Knowledge

In addition to values and beliefs within retail management, lack of knowledge regarding the factors that influence levels of food waste also perpetuate this issue. Research indicates that “knowledge and capacity of supply chain actors” contributes to food waste.⁹⁹ Moreover, in

⁹⁶ Julian Parfitt, Mark Barthel, and Sarah Macnaughton, “Food Waste within Food Supply Chains,” 3072.

⁹⁷ Jenny Gustavsson, et al., “Global Food Losses and Food Waste,” 11.

⁹⁸ Nicoleta Uzea, Martin Gooch, and David Sparling, “Developing an Industry Led Approach,” 20.

⁹⁹ “Food Wastage Footprint,” 8-9.

more affluent countries, there is a general belief that the cost to divert food will outweigh the cost of throwing food away in landfills.¹⁰⁰ However, a report by Value Chain Management International Incorporated suggests that businesses can significantly reduce operating costs by implementing better management techniques.¹⁰¹ Consequently, a challenge for policy-makers is to develop and provide education and resources that will encourage retailers to improve current management practices that lead to food waste.

Lack of Quantification

For retailers to understand the potential cost savings and benefits of diverting food away from landfills it is necessary to quantify the amount of food being wasted in the first place. A current challenge to policy-makers attempting to reduce food waste is how to accurately estimate the amount of food being wasted post-harvest.¹⁰² Without accurate data, it is a challenge to predict the economic cost of food waste making it difficult for retailers along the supply chain to act. In a 2011 study, the FAO reported that improved data collection is required to quantify the amount of food being wasted worldwide.¹⁰³ In a 2013 follow up study, the FAO reiterated the importance of calculating specific aspects of food waste such as the economic cost of the amount of food being wasted.¹⁰⁴ The collection and dissemination of more accurate data on the costs associated with food waste may empower retailers to implement changes and reduce waste behaviours.

¹⁰⁰ Jenny Gustavsson, et al., "Global Food Losses and Food Waste," 12.

¹⁰¹ Martin Gooch and Abdel Felfel, "\$27 Billion Revisited," 30.

¹⁰² Vaclav Smil, "Improving Efficiency and Reducing Waste," 20.

¹⁰³ Jenny Gustavsson, et al., "Global Food Losses and Food Waste," 15.

¹⁰⁴ "Food Wastage Footprint," 55.

Low Price of Food and Disposal Costs

The low price of food relative to income and insignificant disposal costs have also played a role in perpetuating food waste. As the ratio of total income earned to income spent on food has steadily decreased since the 1960s to 2007, individuals and families are able to buy more food.¹⁰⁵ Therefore, the current price of food does not reflect the negative impact of food waste on society. The increase in income, coupled with stringent consumer demands for products, has led to an overstocking in stores. Consequently, the excess food that is not purchased by consumers ends up in landfills. In addition to an increase in the amount of food being supplied in grocery stores to meet consumer demands, the cost to dispose of food waste does not reflect the true cost of food waste on society. As a result, some businesses do not explore improved waste reduction strategies within their waste management policies and continue to dispose of food waste in landfills.¹⁰⁶

Liability

Liability and proper food storage are also factors that lead to edible food entering landfills. The FWRA identified “liability concerns” as a factor preventing businesses from donating food to local agencies due to concerns over the spoilage of food and unfamiliar guidelines.¹⁰⁷ These concerns were most troubling for small restaurant companies, large restaurant companies, and retail and wholesale companies.¹⁰⁸ The FWRA suggests partnering with agencies that connect donations from retailers with local organizations, such as food banks, in order to ensure

¹⁰⁵ Nicoleta Uzea, Martin Gooch, and David Sparling, “Developing an Industry Led Approach,” 12.

¹⁰⁶ *Ibid.*, 19-20.

¹⁰⁷ Food Waste Reduction Alliance, “Volume 2,” 14.

¹⁰⁸ *Ibid.*, 14.

regulations and compliance standards are being met.¹⁰⁹ In addition to liability, businesses also pinpoint confusion over the meaning of “best before” and “use by” dates as a factor that leads to food waste.¹¹⁰ The FWRA recommends establishing “allowable code date extensions on a product by product basis” to create greater flexibility for retailers that donate food.¹¹¹ Furthermore, the European Commission is currently considering methods to modify and clarify these rigid standards without compromising safety.¹¹² Lack of clarification regarding donation guidelines prevents the donation of edible food, therefore, policy-makers can reduce food waste in the retail food market by clarifying the steps retailers can take to safely donate food.

Analytical Framework

Model of Supply and Demand

According to a model of supply and demand, the quantity of a good demanded is “the amount of good that buyers are willing and able to purchase” thus “other things being equal, the quantity demanded of a good falls when the price of the good rises.”¹¹³ Conversely, the quantity of a good supplied is “the amount of a good that sellers are willing and able to sell” thus “other things equal, the quantity supplied of a good rises when the price of the good rises.”¹¹⁴ Finally, within this model, when the quantity demanded is equal to the quantity supplied, the market is in equilibrium and the price is balanced between the cost to produce

¹⁰⁹ *Ibid.*, 15.

¹¹⁰ “Date Marking and Food Waste,” (European Commission), accessed June 3, 2017, https://ec.europa.eu/food/safety/food_waste/eu_actions/date_marking_en.

¹¹¹ Food Waste Reduction Alliance, “Volume 2: Best Practices,” 17.

¹¹² “Date Marking and Food Waste.”

¹¹³ Gregory N. Mankiw, Ronald D. Kneebone, and Kenneth J. McKenzie, *Principles of Microeconomics*, 6th Edition (Toronto: Nelson Education Ltd., 2014), 69.

¹¹⁴ *Ibid.*, 75.

and the cost to consume.¹¹⁵ Consequently, when the market is in equilibrium, the cost to supply food would equal the cost to consume food and government intervention is unnecessary. However, based on the literature outlined above, there is an oversupply of food in the retail food market that is resulting in food entering landfills which generates negative externalities within society.

“An externality arises when a person engages in an activity that influences the well-being of a bystander but neither pays nor receives any compensation for that effect.”¹¹⁶ Consequently, when an externality poses a cost to society it is a negative externality. In the case of food waste, the negative impact of food entering landfills is that it breaks down and emits harmful gas into environment, results in foregone cost savings to retailers and a foregone opportunity to divert food to individuals who are food insecure. The costs of these externalities are not currently reflected in the price to supply and consume food in the retail food market resulting in an inefficient market. Market failure is a “situation in which an unregulated competitive market is inefficient because prices fail to provide proper signals to consumers and producers.”¹¹⁷ Thus, government intervention in the form of policy, such as regulations or corrective taxes and subsidies, may be implemented to influence the retail food market.¹¹⁸

¹¹⁵ Ibid., 79.

¹¹⁶ Ibid., 212.

¹¹⁷ Robert S. Pindyck and Daniel L. Rubinfeld, *Microeconomics*, 7th Edition (Upper Saddle River: Pearson, 2009), 315.

¹¹⁸ Gregory N. Mankiw, Ronald D. Kneebone, and Kenneth J. McKenzie, *Principles of Microeconomics*, 219-220.

Economic Model to Evaluate Policies

This paper will use a model of supply and demand to examine various policy responses used to influence food waste in the retail food market. The model will demonstrate the retail food market, highlight the amount of food being wasted within this market, attempt to explain why there is a surplus in food and explore the potential impact that each policy will have on the amount of food wasted by retailers. However, the issue of food waste is perpetuated by many challenges discussed within the literature review. Therefore, the findings section will provide a discussion that integrates the model used to demonstrate food waste in the retail food market with the findings of the literature review. This discussion will centre on how government can intervene, considering the challenges that perpetuate food waste, and use policy to encourage retailers to decrease the level of food waste they send to landfills.

Research Methodology

This project will use a model of supply and demand to evaluate the policies that are used to address the negative externalities generated by food waste within the retail food market. Current food waste regulation policies fall into three broad categories; command-and-control policies, market-based policies, and education/voluntary initiatives. Command-and-control policies aim to prohibit a specific action or behaviour through direct regulation while market-based policies aim to alter behaviour by creating incentives or disincentives through corrective taxes or subsidies.¹¹⁹ Moreover, education/voluntary initiatives attempt to provide businesses with information and knowledge about the positive benefits of introducing food waste prevention within their business models to reduce negative waste behaviour.

¹¹⁹ Ibid., 220.

Conceptual Modelling

Due to a lack of quantification of the level of food wasted in Canada, this paper will use a theoretical model of supply and demand to conceptualize the impact that specific policy interventions have on the behaviour of retailers that leads to food waste. To generate a model to evaluate each policy option, the analysis will begin with a model of the retail food market in perfect equilibrium, where no externalities exist and government intervention is unnecessary. From there, a second model will build upon the original to demonstrate the current retail food market and attempt to clarify why there is an oversupply of food. This model will highlight the market for food, the current demand and supply of food, as well as the amount of food being wasted. Furthermore, this model will display the optimal quantity of food that should be supplied in stores to reduce the negative externalities generated by food waste. Finally, a discussion will be carried out to determine the potential impact of each policy intervention on food waste behaviours. The policy responses that will be discussed include: government aid to encourage the free-market solution of food banks, subsidies that incentivize the donation of food, taxes that discourage food waste, and education/voluntary initiatives that encourage retailers to implement behavioural changes.

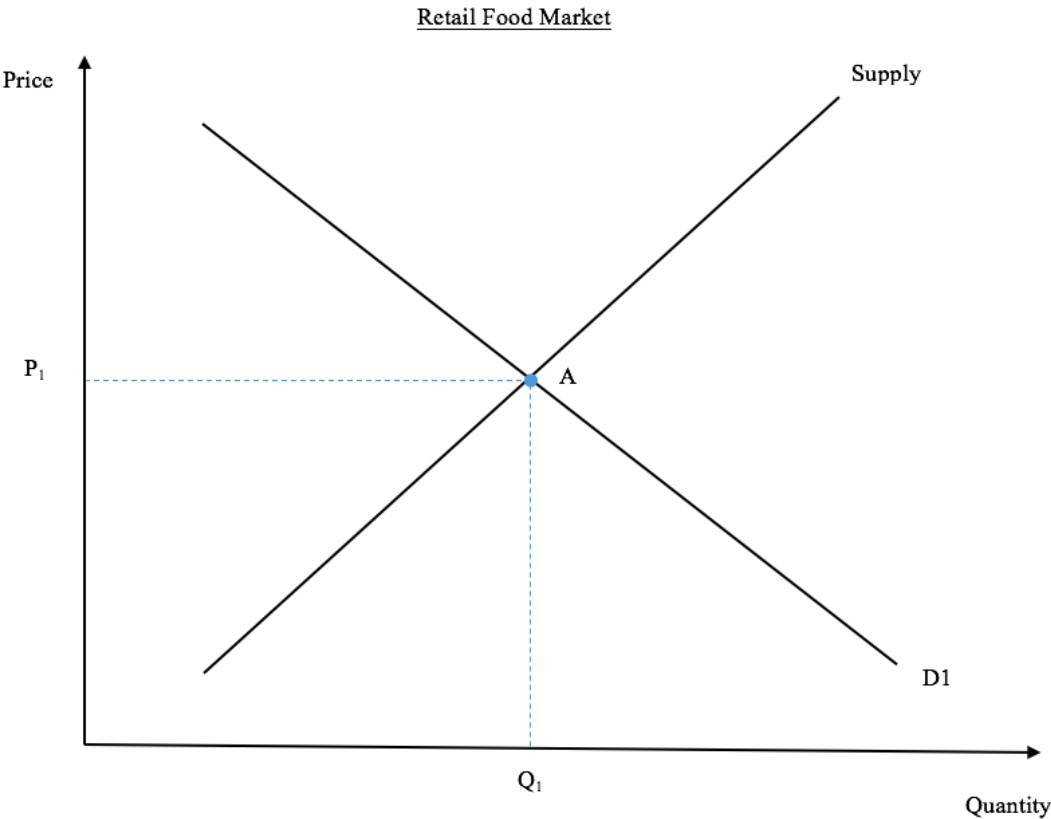
Limitations

In the absence of accurate quantification, this paper develops a conceptual model to theorize which method of government intervention is most appropriate to address the issue of food waste. Thus, a limitation of the research methodology is that the models developed are simply theoretical and do not demonstrate the comprehensive effects that the various policy interventions will have on the level of food waste generated within the retail food market.

Although the literature regarding food waste provides a clear indication that various externalities are generated and action is required to address this issue, it is difficult to quantify the magnitude of these externalities. Thus, the models provide a simplified version of the retail food market in Canada, subsequent food waste, and externalities generated. Therefore, any findings reported in the analysis are based upon a theoretical model and must be interpreted as such.

Findings

Model A - Retail Food Market at Equilibrium



Interpretation of the Model

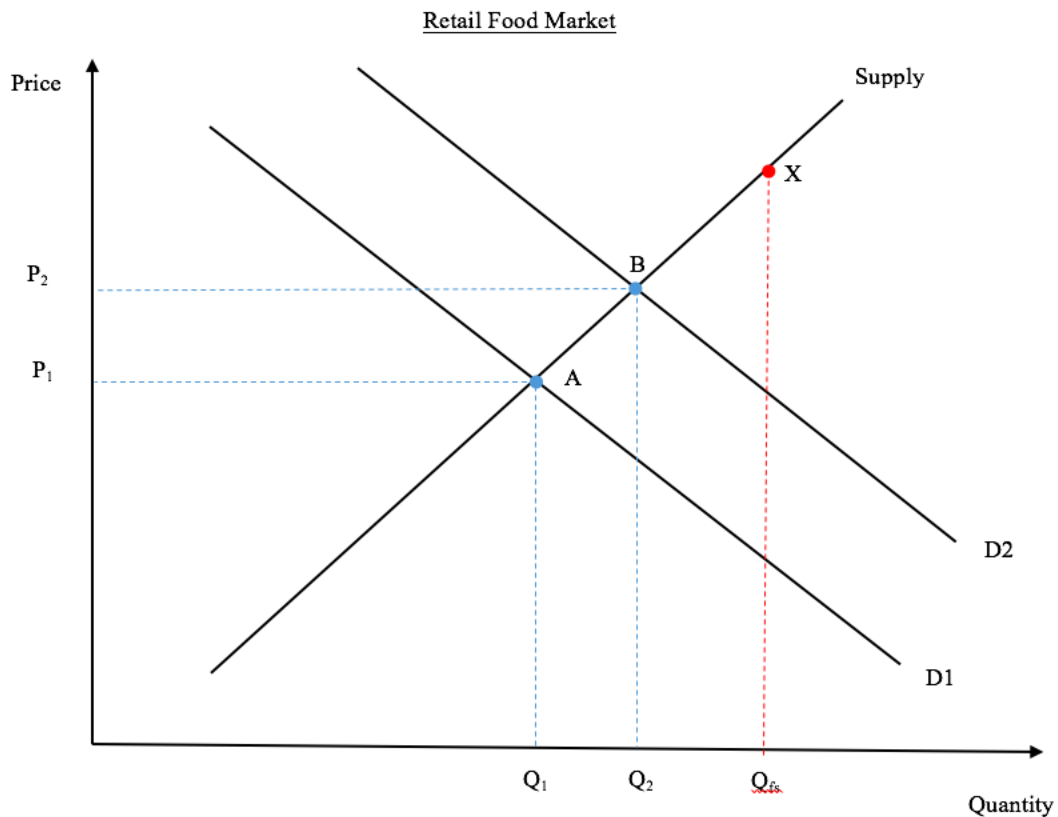
Model A demonstrates the retail food market in equilibrium absent of market failure. When the market is in equilibrium the quantity of food demanded by consumers is equal to the quantity

of food supplied by retailers (Q1). Thus, the retail food market has reached Pareto optimal and neither consumers nor retailers can be made better off without making the other worse off. This model shows that, when the market is in equilibrium, there is no need for government intervention as the price to consume food is the same as the price to supply food (see point A) and no negative externalities are present. However, the main limitation of this model is that it assumes there are no market failures within the retail food market. The literature regarding food waste identifies several negative externalities that are generated by food waste. Thus, this model is an incorrect conceptualization of the retail food market within Canada and does not provide an accurate picture of why there is a surplus in food.

Understanding the Story of Food Waste

As discussed in the literature review, the externalities of food waste are a result of the values and beliefs ingrained within organizational management structures, consumer demands regarding aesthetics and diversity of products, lack of knowledge and quantification regarding food waste and foregone cost savings, low prices to buy food as well as dispose of unconsumed food, and concerns regarding liability when donating food. These factors reveal a relationship between the demands of consumers and the behaviour of retailers which results in food being wasted. The following model demonstrates why there is an oversupply of food waste within the retail food market and how these externalities can be addressed through government intervention.

Model B - Retail Food Market with A Negative Externality



Interpretation of the Model

This model shows that retailers are faced with two demand curves (D1 and D2) which represent what consumers are willing to pay for food. D1 identifies the price that consumers are willing to pay for food if the retailer does not keep their shelf fully stocked, thus decreasing the amount of food wasted (Q_1). D2 identifies the price that consumers are willing to pay if retailers have fully stocked shelves (represented by the quantity Q_{fs}) which results in food waste (given by the difference between $Q_{fs} - Q_2$).

For example, if the retailer were to maintain a half-empty shelf of bread in the bakery, consumers may interpret the space on the shelves as a lack of quality bread and only be willing to pay a smaller price for their bread than if shelves were fully stocked. Thus, retailers attempt

to keep shelves fully stocked to provide consumer with the perception that the bread is high quality and not “picked over”. This model demonstrates that when retailers oversupply food on their shelves they receive a higher price for the quantity of food being sold.

The supply curve (Supply) represents the quantity of food that the retailers are willing to provide at any given price. This supply curve shows the rising marginal cost for retailers to supply food. The goal of the retailer is to sell a quantity of food that falls somewhere on the supply curve, even if this means overstocking their shelves.

The vertical line (Q_f s) shows the amount of food that retailers must offer for sale for their shelves to be fully stocked. However, this amount of food is not cost-minimizing for the retailer. The retailer is aware that they will not sell Q_f s of food, but if they supply that amount they will sell Q_2 and receive P_2 (see point B). This is because consumers want to see fully stocked shelves in order to pay a higher price for food.

If the retailer does not maintain fully stocked shelves consumers will pay less for food. Thus, with a partially empty shelf retailers are faced with demand curve 1 (D_1), which means they will only sell Q_1 and receive a lower price of P_1 (see point A). However, if the retailer fully stocks their shelves they are faced with demand curve 2 (D_2), which means they will sell Q_2 and receive a higher price of P_2 (see point B).

Choosing the “fully stocked” option gains producer surplus equal to the area P_1ABP_2 . But to get the fully stocked option, the retailer needs to suffer the additional cost given by the area $BQ_2Q_f sX$. If the first area exceeds the second, the retailer fully stocks and dumps some of their production. Thus, when comparing the two choices the retailer will take the “fully stocked”

option because this provides them with a greater surplus. However, this option results in negative externalities that impact society when food waste enters landfills.

Thus, the next step in the food waste story is to discuss the different policy responses that may be implemented to address the negative externalities generated from food waste. Model B, above, demonstrates that policy must aim to directly increase the cost for retailers to maintain fully stocked shelves. Specifically, the chosen policy response must increase the cost to fully stock shelves by the cost of the negative externality. Although this policy may not completely discontinue the practice of overstocking shelves within the retail food market, it will force retailers to internalize the externality resulting in the optimal amount of food being stocked. The following section discusses the benefits and limitations of the various policy responses that governments can utilize to address the externalities generated by food waste.

Discussion of the Findings

Free Market Solution

Food banks were created as a free market solution to food waste in which edible food, that would otherwise enter landfills, is diverted to individuals who are food insecure. Interestingly, the government did not drive the creation of food banks, instead, they were created as a response to the level of food being wasted and the issue of food insecurity within society. However, despite the creation of food banks food waste continues to occur, which results in negative externalities. While some retailers donate surplus food to food banks others choose to continue to dispose of food. This leads to the question, why does the free market solution of food banks fail to prevent food waste from occurring?

Recall from Model B above that, in order to change behaviour, governments must use policy to ensure that retailers incur a cost equal to the benefit of fully stocking their shelves. Therefore, the continued waste may be a result of minimal tipping fees at local waste facilities that are not high enough to discourage retailers from donating food at the local food bank rather than disposing of food in landfills. Furthermore, a lack of knowledge regarding foregone cost savings may also lead retailers to continue to use landfills. If retailers are unaware of the benefit of donating food to the local food bank, such as not paying a tipping fee and receiving a tax receipt, they may continue to dispose in landfills. Finally, retailers may have concerns regarding liability when considering the option of donating food to local food banks or agencies, which prevents them from making behavioural change in waste diversion. However, despite these factors, while food banks decrease the level of food entering landfills they are not sufficient in encouraging retailers to decrease the amount of food they stock on their shelves because they do not force retailers to internalize the cost of food waste. The following sections will explore the role that government can play in decreasing the amount of food being wasted using a subsidy versus a tax, as well the role educational policy can play.

Subsidy

A subsidy is an incentive that works by decreasing the cost for retailers to donate food. Thus, governments can provide a subsidy to encourage retailers to reduce the amount of food being wasted within the retail food market. For example, retailers receive a tax receipt when they donate food to local agencies or food banks worth a certain percentage of the total value of their donation. Thus, a subsidy encourages the donation of food and results in cost savings to

retailers, while also minimizing the negative externalities generated by food waste in the retail food market.

Limitations

There are several limitations that must be considered when using a subsidy to increase the diversion of food waste. For example, subsidies treat firms differently because they allow each firm to decide whether they will divert food or continue to dispose in landfills. However, as opposed to a tax, where firms will either change food waste behaviour or pay a tax, the subsidy does not penalise firms that do not alter their behaviour. Thus, some firms will continue to waste at high levels without consequence, regardless of the subsidy. Furthermore, a subsidy only encourages the diversion of food waste away from landfills. Thus, it is an indirect policy that may result in less food entering landfills but does not directly force retailers to order less food than is required to keep shelves fully stocked. While a subsidy encourages positive food waste behaviour and compliments the free market solution of the food bank, it does not force retailers to internalize the cost of the externalities.

Another limitation of this policy option is that it is difficult to determine the correct size of subsidy that would encourage food diversion within the retail food market. In theory, the subsidy would need to provide a greater benefit to the retailer than the benefit of having fully stocked shelves to initiate extensive change. However, government subsidies are publicly funded and supported through taxpayer dollars. Thus, policy-makers must also consider the cost incurred to provide a sizeable subsidy, which may outweigh the benefit of diverting surplus food.

Time is another factor not considered within the model. Policy-makers must explore whether a subsidy should be implemented long-term or whether it should be gradually decreased over time. A subsidy provides time for firms to implement improved waste diversion methods for dealing with food waste, with the aid of government financial support. Moreover, smaller retailers may require a subsidy over a longer period of time to cover the additional cost of donating food that results from infrastructure or transportation costs. Therefore, policy-makers must determine whether the level of support from a subsidy should decrease as firms' efficiency increases over the long-term, or if it should be a permanent piece of the food waste solution.

Tax

As opposed to a subsidy, a tax is a penalty imposed on retailers when they waste food. This policy is an alternative tool that governments can use to reduce the amount of food waste entering landfills. With a tax, the cost for retailers to maintain fully stocked shelves exceeds the benefit because they must pay the tax in addition to the price to supply the food. Thus, a tax is a direct policy response that increases the cost for retailers to maintain fully stocked shelves. Another benefit of the tax is that it generates revenue which the government can use to fund alternative waste initiatives that encourage retailers to divert food.

Similar to a subsidy, a tax treats each firm differently and allows them to choose to respond in a variety of ways. Firms can choose to stock less food on their shelves, sell food close to expiry at a discounted rate, divert excess food to local agencies, or simply incur the cost of the tax. Some firms will continue to dispose of food in landfills because the expense to implement new diversion techniques exceeds the cost of the tax. In general, firms will attempt

to find a way to respond to the tax that makes them better off. For example, if firms do not have proper infrastructure to ensure food being donated is transported safely, it may cost more to develop this infrastructure, therefore, they will continue to dispose of food in landfills and pay the tax. In contrast to a subsidy, the tax ensures there are consequences for firms that continue to generate food waste and regardless of their response, thus, the tax has successfully forced retailers to internalize the cost of the externalities of food waste.

Limitations

There are several limitations when using a tax to reduce food waste in the retail food market. For example, a limitation of this model is that it assumes that both demand and supply are relatively elastic. However, the elasticity of supply and demand will determine whether the consumer or the retailer will bear the burden, or the incidence, of the tax. If the demand curve is inelastic the burden of the tax will fall more on consumers. Furthermore, if the incidence falls mainly on consumers and the price of food consumption rises, low-income individuals will feel the impact of the tax more than higher income individuals because they have less disposable income and will spend more of their income on food as a result. Conversely, if the supply curve is inelastic the burden of the tax will fall more on retailers. In which case, smaller businesses with less resources and capital will feel the burden of the tax more than larger retailers that have access to more resources and capital.

In addition to the determining which party bears the incidence of the tax, some retailers will find alternative methods to dispose of waste without following appropriate waste diversion techniques highlighted in the waste diversion hierarchy. Policy-makers must be aware of the alternative methods that retailers will use to continue to waste and avoid paying the tax and

attempt to minimize these actions. As a result, a tax requires consistent regulation which involves government resources for government employees to monitor and enforce. Thus, policy-makers must consider the cost of administrative fees, funded through taxpayer dollars that are required to implement a tax on food waste.

Finally, a limitation of this tax is that, while it aims to reduce wasteful behaviour, it ignores other factors that may influence food waste within the retail food market. For example, the high level of food waste may be a result of insufficient infrastructure, storage, transportation, as well as fears regarding liability and a shortage of workers available to take on the extra work to donate the food. Thus, it may impose a cost on retailers that cannot be internalized and result in some retailers dropping out of the market. This decrease in available retailers could potentially have a negative impact on consumers. For example, if a retailer cannot afford the tax and cannot develop sustainable waste solutions they will leave the market and consumers have less choice when shopping for food. Both subsidies and taxes have limitations that pose challenges to policy-makers that must be considered when developing an appropriate policy response to food waste.

Education

Government sponsored education and voluntary initiatives provide firms with the resources and knowledge to help them understand the advantage of altering current food waste behaviour and the steps to do so. When governments deliver educational policy, they incur the cost to develop resources and supply information instead of retailers within the retail food sector. Thus, this type of policy minimizes the difference between the cost carry out research and implement changes in food waste practices. This is beneficial for firms that are unwilling or

unable to carry out the research to understand food waste within their firm and make the appropriate changes. While education is not a comprehensive solution to food waste, it serves to complement other policy options.

Limitations

A limitation of using education as a policy tool is that it is difficult to determine how large of an impact it will have on overall food waste. Moreover, it is impossible to determine exactly what “quantity” of education it would require to reach the social optimum. Due to the voluntary nature of educational initiatives, many firms will opt out and choose not to access the resources and education provided by the government. Therefore, this policy response may result in the government spending large sums of taxpayer dollars to provide education and resources for retailers with a very small decrease in the level of food waste in the retail food market. Without policy interventions that either incentivize or discourage food waste some retailers will continue to waste at the same level and the negative externalities will continue to exist.

Conclusion

Directions for Further Research

This paper looks specifically at the negative externalities generated by food waste within the retail food market. However, it is important that future research expand to consider other market failures that lead to food waste. Furthermore, this paper is focused mainly on the impact of taxes, subsidies, and educational policies on waste behaviour. Specifically, this paper attempts to understand the impact of a direct policy, such as a tax, versus indirect policy, such as a subsidy and education, on food waste within the retail food market. The author concludes that, although indirect alternative policy options can play an important role in the reduction of

food waste, a direct policy response, like a tax, is the most effective policy response because it will force retailers to change their behaviour or simply pay the tax, thus internalizing the externalities of food waste.

In addition to the discussion presented within this paper, future research should aim to explore indirect policy responses that will enhance the impacts of a direct policy on food waste. For example, policy-makers should explore the correct cost for waste disposal at landfills based on the size of the externality of food waste. Alternatively, policy-makers should explore the impact of an organics ban on retailer food waste. While the main goal of these two policies is to reduce landfill use, an indirect benefit of increasing the cost to waste may result in less food waste. The findings of this future research will add depth to the policy responses discussed within this paper.

For policy-makers to alter existing behaviours that lead to high levels of food waste, it is necessary to identify the root causes of waste as well as quantify the amount of food wasted along the entire food supply chain. Due to very little data on food waste, Model B presented in the findings, was used to conceptualize the demand and supply for food in the retail food market, the subsequent food waste, and discuss the various policy options governments can use to reduce this waste. Consequently, this model does not demonstrate the actual amount of food being wasted or how the market will respond to a tax or subsidy. Therefore, in order to develop an appropriate policy response, policy-makers first must gain an accurate understanding of food waste across sectors in Canada. Future research should aim to quantify the amount of food being wasted within the Canadian retail food market. In the absence of

detailed data on food waste policy-makers will continue to make assumptions regarding the retail food market and the efficacy of various policy responses.

Policy Implications

The focus of this paper has been on, what Smil refers to as, “the growing gap between food production and food consumption” within the retail food market and how policy can be used to address the resulting negative externality.¹²⁰ The relationship between the stringent demands of consumers and the response by retailers to fully stock shelves results in high levels of food entering landfills. These actions “have become quite difficult and complicated to justify from the ethical and social point of view. The environmental and economic impact of such consumers’ demands has become increasingly prominent and measurable.”¹²¹ Thus, the challenge for policy-makers and government is to develop an appropriate policy response to reduce the current levels of food waste within the retail food market.

It is apparent that decision making plays a central role in the amount of food wasted within the retail food market. In a working paper, the FAO defines food waste as, “food losses resulting from decisions to discard food that still has value.”¹²² Therefore, the key to finding an appropriate response to the issue of food waste, is to explore the policy options that discourage the conscious decision to discard “*food that still has value*” in the retail food market. As

¹²⁰ Vaclav Smil, “Improving Efficiency and Reducing Waste,” 7.

¹²¹ Radojko Lukic, Dragana Vojteski Kljenak, and Dragica Jovancevic, “Retail Food Waste Management,” *Management Research and Practice; Bucharest* 6, no. 4 (December 2014): 23–37, <http://ezproxy.lib.ucalgary.ca/login?url=http://search.proquest.com.ezproxy.lib.ucalgary.ca/docview/1635393632?accountid=9838>.

¹²² Andrea Segre, Luca Falasconi, Alessandro Politano, and Matteo Vittuari, “Background Paper on the Economics of Food Loss and Waste: Working Paper,” (Food and Agriculture Organization of the United Nations, 2014), 6, <http://www.fao.org/3/a-at143e.pdf>.

discussed in the findings, there are a variety of approaches that government can use to encourage the diversion of edible food away from landfills. While there are limitations to each approach, a tax on food waste appears to be the most direct approach to decreasing food waste within the retail food market. However, isolated policies alone cannot change current waste trends in the retail food market and must work in tandem to address this complicated issue.

Despite the presence of food banks in Canada, which encourage the donation of food, there continues to be a large amount of food being disposed of in landfills by retailers. This waste is a result of retailers choosing to overstock their shelves in order to receive a higher price for food. Thus, one option for governments to further encourage the free market solution of food banks is to offer a subsidy to retailers who donate food which lowers the cost incurred by retailers. However, this does not always directly influence retailer management techniques and over-ordering to maintain fully stocked shelves. Moreover, due to the optional nature of a subsidy, retailers can either donate food or continue to discard of excess food without penalty. Thus, while this policy response encourages positive waste behaviour, it fails to completely address the issue because it does not force retailers to internalize the cost of the externalities generated by food waste.

Similar to a subsidy, educational policy encourages firms to implement changes within their waste management policies and decrease the amount of food they waste. This option utilizes government funded programs and resources to lessen the cost on retailers by providing information that helps firms decrease their waste. Thus, educational policy compliments the

efforts of other government policies and encourages retailers to form a partnership with the government to combat food waste.

Recall from the findings that, in order to truly address the externalities generated by food waste, policy options must aim to increase the cost of maintaining fully stocked shelves until it exceeds the extra benefit of doing so. Thus, an appropriate tax on food waste will achieve this goal if it forces retailers to internalize the cost of the negative externality. In response to a tax, some retailers will stock less food on their shelves (and receive a lower price for food), others will divert extra food to local food banks and agencies while some will explore the option of creating alternative prices for day-old food. Conversely, some retailers will incur the cost of the tax because alternative waste options cost more than simply paying the tax. Thus, a benefit of a tax is that it provides some freedom and allows retailers to choose to respond in a variety of ways. However, regardless of the response, the tax forces the retailers to internalize the cost to society that results from food waste. Moreover, the revenue generated from the tax can be used on alternative methods to decrease food waste, such as making educational resources readily available to retailers or investing in waste diversion infrastructure.

Policy Implementation

Quantifying food waste is a vital step towards reducing high levels of waste within affluent countries.

A central argument in the Reference Manual is that governments will have difficulties in achieving a significant de-coupling of waste generation from growth in Gross Domestic Product unless they direct rigorous attention to three core activities: 1) quantitative waste prevention target setting, 2) selection and implementation of appropriate instruments, and 3) evaluation of waste prevention programme performance in environmental, economic and social terms.¹²³

¹²³ “Working Party on Pollution Prevention and Control,” 3.

Thus, despite considerable challenges to quantification, as population and demand for food continues to grow, it is essential that Canada implements sustainable food waste diversion policies, in order to address the negative externalities of food waste.¹²⁴

Currently, there is a global trend towards government involvement in food waste reduction efforts. Accordingly, as different levels of government within Canada explore their role in addressing food waste, policy-makers can learn from the actions taken by other countries that have attempted to develop effective food waste diversion policies. It is essential that Canada establish a waste hierarchy model in order to prioritize various methods of waste diversion as well as determine a common definition of food waste for clarity amongst stakeholders.¹²⁵ Furthermore, Canada, should adopt a model similar to the European Union by establishing specific goals to significantly decrease food waste.¹²⁶ Each level of government within Canada must work together to establish sustainable waste diversion policies within waste management frameworks as the amount of food entering landfills continues to grow. In order to do this, policy-makers must decide approach they will use to encourage and enforce positive food waste behaviour. However, without quantification and constant monitoring the Canadian retail food market will continue to waste high levels of food without consequence.

¹²⁴ “Working Party on Agricultural Policies and Markets,” 32.

¹²⁵ Nicoleta Uzea, Martin Gooch, and David Sparling, “Developing an Industry Led Approach,” 17-19.

¹²⁶ “EU Actions Against Food Waste,” (European Commission, last modified January 24, 2017), https://ec.europa.eu/food/safety/food_waste/eu_actions_en.

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