



Food Waste in Canada

Opportunities to increase the competitiveness of Canada's agri-food sector, while simultaneously improving the environment

November 2010

Martin Gooch, Abdel Felfel, Nicole Marenick



Along with the rest of the world, Canada invests enormous resources in seeking ways to feed a growing population through increased production. Far fewer resources are invested in making more effective use of the food already produced, even though doing so would have immediate results.

An estimated \$27 billion in Canadian food annually finds its way to landfill and composting, creating unnecessarily high levels of carbon and methane. More effectively managing the food already been produced would significantly benefit our economy and the environment. This paper looks at the entire food system in order to identify primary causes of waste. It then suggests ways in which Canada's agri-food sector could increase its competitiveness and, simultaneously, reduce its environmental footprint through reduction of food waste.

Putting Canada's Food Waste in Perspective

The quantifiable difference in value between what is produced on farms, then processed, distributed and sold every year, compared to what is consumed, exceeds \$27¹ billion. This equates to approximately 40% of all the food we produce and 2% of Canada's GDP (Statistics Canada, 2010; Macdonald, 2009). To put things in perspective, \$27B is:

- More than Canadians spent on food purchased from restaurants in 2009.
- Slightly below the value of all Canadian agricultural and agri-food exports in 2007.
- Greater than the value of all Canada's agricultural and agri-food imports in 2007.
- Higher than the combined Gross Domestic Product (GDP) of the 32 poorest countries (World Bank 2009).

While this number is significant, it only equates to 'terminal' food waste - that which mostly goes to landfill or composting. If we used the Lean Manufacturing definition of waste, which is that waste includes any activity that costs more than the value it creates (Womack & Jones, 2005), then the true extent of agri-food waste impacting Canada's agri-food industry², the economy, and the environment is much greater. The question that therefore needs to be asked is ***"What is going wrong with the current food value chain and what can be done to address this crisis?"***

What is waste?

Waste occurs at every level of the food value chain and there are many causes. The website www.lovefoodhatewaste.com (2010) used cheese as an example of how waste impacts us financially and environmentally. It is not just the products themselves that are lost; it is the energy, water, packaging and human resources used in production, transportation, retailing/food service and home storage: "...(from) feeding and milking the cows, cooling and transporting the milk, processing it into cheese, packing it, getting it to the shops, keeping it at the right temperature. If it then gets thrown away, it may end up in a landfill site, where rather than harmlessly decomposing as many people think, it rots and actually releases methane, a powerful greenhouse gas."

¹ See Appendix A for a breakdown of the \$27B of food we estimate as wasted in Canada annually.

² The term agri-food encompasses the entire range of operations involved in producing a food product, including producers, processors, distributors, retailers and foodservice operators.

While a certain amount of waste will always occur, the extent of waste occurring in agri-food is higher than other industries due to a general lack of willingness and/or inability to coordinate activities occurring along the value chain (Dunne, 2008; Fearne, 2007; Fortescue, 2006).

Why is there so much waste?

Before we address factors that create the greatest waste in Canada's present food system, we need to address two commonly held, though incorrect, assumptions: the impact of food miles and plastic packaging.

Food Miles

Food miles are often portrayed as the environmental demon and creator of waste. **At 3%, food miles are actually the least significant contributor to food waste.** Neither is food distribution a significant contributor to greenhouse gas (GHS) emissions compared to the overall food system (Weber & Matthews, 2008; Desrochers & Shimizu, 2010; Saunders & Barber, 2007). In fact, local food production can create higher levels of waste than otherwise occur. For example, a study by Gooch et al (2009) found that, largely due to differences in technology and resources, the percentage of waste associated with selected types of Ontario-grown fruit was at least double that of California-grown fruit.

Plastic Packaging

Food waste creates methane, a gas 25 times more damaging to the environment than CO² (WRAP, 2010a; NOAA, 2008). This illustrates that **it is short sighted to raise concerns about plastic packaging without looking at the wider context.** More greenhouse gases are created from food wasted by households than by plastic packaging (WRAP, 2010). Plastic packaging actually benefits us through markedly reducing food waste, by protecting food during transportation and handling (Anonymous, 2009). Being lighter and more durable than glass, it also reduces distribution costs (WRAP, 2010). The downside of plastic is not primarily the material itself; it is the lack of coordination at the municipal level that results in thousands of tonnes of plastic needlessly going to landfill (Anonymous, 2010a; Hughes, 2010), which increases its carbon footprint unnecessarily.

The Primary Causes of Waste

So, if food miles and plastic packaging are not the main causes of waste along the food chain, what are? Figure 1 lists the seven factors that Womack and Jones (2005), along with the Lean Enterprise Research Centre (LERC, 2010), the Institute of Grocery Distribution (IGD, 2010) and the Value Chain Management Centre (VCMC) (Gooch et al, 2009), have identified as creating excessive waste along processed and fresh food value chains.

Figure 1: The seven creators of waste

Factor	Types of waste that occur as a result
Overproduction	<i>too much production and/or poor flow of products through the chain, often resulting in the need to discount in order to flow products through the system before they spoil</i>
Defects in products or equipment	<i>poor quality products, poorly operating equipment, communication errors, shortened shelf-life, poor delivery</i>
Unnecessary inventory	<i>occurs at any point along the chain, including in households; creates excessive delay, poor customer service, long cycle times, excessive spoilage</i>
Inappropriate processing	<i>incorrect procedures or systems, often when simpler approaches would be more effective</i>
Excessive transportation	<i>excessive, often complex and costly movements of products or information</i>
Waiting	<i>long periods of inactivity result in poor materials or information flow, long lead times, and increased spoilage</i>
Unnecessary motion	<i>poor design of any link or workplace along the chain, or the overall chain itself, often leading to lost or damaged items</i>

These factors result from the behaviour of individuals. These behaviours are themselves determined by the incentives, policies and processes that, together, shape the way the agri-food sector is structured and operates. For ease of digestion, we have categorized the human behaviours that create excessive waste as follows: consumers; business managers; and the unintended consequences of policy and legislation.

Consumer Behaviour

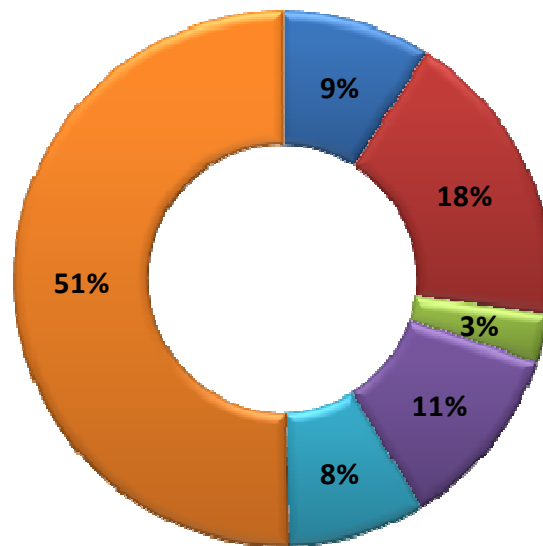
Based on currently available information, Figure 2 shows that the largest single contributors to waste are consumers. More than 50% of the \$27B in food waste originates from food thrown away in Canadian homes. Studies in the UK concluded that the vast majority of consumer food waste³ could be avoided, and that, while approximately one-fifth of food thrown away includes items such as peelings, cores and bones, the rest was once perfectly edible.

The main reasons food becomes garbage include cooking/preparing too much, not using the food in time, and a lack of confidence to use leftovers. Foods that comprise the majority of avoidable household food and drink waste are those that require or benefit from refrigerated storage. They include fresh/raw meat and fish, ready meals, dairy products, fruit and vegetables and pre-prepared foods.

³ Consumer food and drink waste in the UK is estimated to be 8.3 million tonnes annually.

Figure 2: Percentage of waste created by activities through the agri-food value chain

Percentage of Food Waste Throughout the Chain (field to home) in Canada



Note: HRI = Hotel/Restaurant/Institutional food outlets
(Statistics Canada, 2010; Macdonald, 2009; VCMC, 2010)

Management Decisions

The proportion of food waste that occurs in the home is partly a result of management decisions that exacerbate consumers' quest for value, and distract them from equating what they buy with what they throw out (Brook Lyndhurst, 2010; ESA, 2010). Additionally, as consumer waste includes things such as bones and peelings, the most significant creator of waste is the lack of coordination that commonly occurs along the value chain. This, too, is an outcome of management decisions (Gooch, Marenick & Felfel, 2010; Gooch and Felfel 2009; FCC, 2006).

Canadian retailers are unique in the extent to which they rely on price-oriented fliers as a primary marketing tool (Fearne, 2009). Fliers have the potential to encourage consumers to seek out deals and buy beyond their needs. An almost invariable outcome of this is that consumers place an overly high importance on price and buying in bulk, which then leads to increased waste (WRAP, 2010).

A focus on moving volume by incentivizing consumers to buy on price leads to waste at other levels of the chain as well. For example, price promotions led to a retailer experiencing 12% shrink in its potato category. In addition to the environmental impact, it 'wiped out' the entire profitability for that line item (FCC, 2007). As potatoes are a relatively sturdy produce item, one can only imagine the level of losses that may be occurring in other categories of retailers' produce departments, due to similar management decisions.

Studies by the Value Chain Management Centre showed where lack of coordination along the chain resulted in at least 25% of Ontario peaches being wasted annually (Gooch et al, 2009). Other studies conducted by the VCMC showed unnecessary levels of waste occurring in the red meat sector (Gooch, LaPlain & Felfel, 2009a; Gooch, LaPlain & Felfel, 2009b). In all cases, the reasons for lack of coordination came down to members of the chain not possessing the desire or ability to communicate with each other effectively. This led to a tendency to play the blame game, rather than seek to solve problems together strategically.

Anecdotal discussions with Canadian processors showed that 10 - 40% of the products they handle are wasted. Much of this waste resulted from factors similar to those described above, so could be prevented. Aside from terminal waste, that which goes to landfill or composting, other types of waste that processors experience include receiving products that do not meet the required specifications, leading to the need to downgrade/discount in order to flow them to an alternative (lesser value) market.

The most extensive studies of the extent of food waste occurring along the value chain have been undertaken in the UK, by organizations such as the Institute of Grocery Distributors (IGD) and the Lean Enterprise Research Centre (LERC). Specific examples of waste that IGD and LERC identified as resulting from a lack of coordination along the chain include the following:

- In red meat, the waste that occurs along the chain adds an estimated 10% to the end price. Wastes were created by factors such as inconsistency in carcass composition and production systems.
- Additional waste found to be occurring in red meat included feeding animals until they were overly fat. The latter is not only a waste of feed, it also creates costs for processors by forcing them to invest in resources to trim off and dispose of unnecessary fat.
- In raspberries, up to 75% of fruit can be lost before they reach the retailer, due to ineffective processes, particularly those associated with picking, post harvest cooling and shipping.
- In wheat, a miller rejected 6% of deliveries due to quality issues. The primary cause of the quality issues was the way on-farm processes (inc. growing, harvesting and storing wheat) compromised the consistency and quality of wheat supplied to customers. This one link in an individual chain created \$30,000 in additional annual administration costs and led to thousands of tonnes of grain having to be downgraded.

Unintended Consequences of Policy and Legislation

Canadian policy and legislation, at the provincial and federal levels, negatively impact the level of waste occurring through the system and the impact that such practices have on the environment.

At the farm level, risk management programs and varied marketing regulations alter farmers' needs to respond to market signals. At times, they also alter the market signals themselves. They also lessen farmers' needs to communicate meaningfully with downstream members of the value chain, or ensure that their operations reflect customer and consumer requirements. Thus, many continue producing what they've always produced, in the same way they've always produced it. At the same time, many producers who wish to change how they produce and market their products are prevented or discouraged from doing so by less progressive elements of the current system, or current policies and legislation. This also leads to a focus on sectors and commodities rather than products and processes, which invariably results in unnecessary costs and waste.

At the processing level, while dumping organic waste contributes significantly to greenhouse gases, current legislation makes it "too easy and too cheap to dump, and too difficult to do otherwise. At the very least, all levels of government could lessen the permit and regulatory hurdles that face waste-to-energy projects" (Canadian Processor, 2010). In the present circumstances, installing technology to harvest energy from waste (for example through anaerobic digesters) is a long-term and costly option that many businesses are not willing to undertake without firmer leadership from government, or greater market forces (such as higher electricity prices or unreliable energy supplies). The result: processors view dumping organic waste as making the most economic sense, particularly as our green energy technology is said to trail that of Europe by 10 years or more.

What can be done?

Identifying the causes of waste and ways to address them effectively over the long term requires businesses (and researchers) to look at the entire value chain, not just one part of the system in isolation of the rest. This enables researchers to identify the creators of waste, which are likely bottlenecks in information or product flow, misaligned strategies, or incompatible cultures that exist within or between businesses. Business should then address these issues effectively over the long term to reduce costs and increase profitability through adapting to a changing consumer market and an increasingly competitive business environment.

Research in Canada by the Value Chain Management Centre (for example, Gooch et al, 2010) and elsewhere (for example, FCC, 2007) shows that, regardless of the size of a company, the industry in which it operates, or the type of products or services marketed, significant opportunities exist for individual businesses and entire sectors to improve profitability and reduce waste by adopting value chain management principles. Invariably, the same practices lead to businesses reducing their environmental footprint.

The Value Chain Management Centre has completed projects that resulted in the involved businesses achieving millions of dollars in improved performance while simultaneously reducing their waste.

However, Europe is ahead of Canada in assisting businesses to identify the causes of waste and implement strategies to reduce costs and increase revenue, as well as reducing waste through encouraging changes in consumer behaviour. It can, therefore, offer suggestions on how the Canadian agri-food sector and government can work together more effectively to simultaneously increase industry's competitiveness and improve its environmental sustainability.

Government-Supported Initiatives

Voluntary initiatives, developed with the support of government, have proven an effective means of reducing waste, through encouraging changes in the behaviour of businesses and consumers alike, "without the need for a formal and potentially costly regulatory framework" (Kuyk, 2010). WRAP (2010) and IGD (2010) state ways businesses can be motivated to change their management styles by demonstrating the financial and economic benefits of reducing waste. WRAP (2010) and Weber & Matthews (2008) tell how voluntary initiatives can be an effective means of motivating consumers to change behaviour, leading to a reduction in their food costs and a reduced environmental footprint.

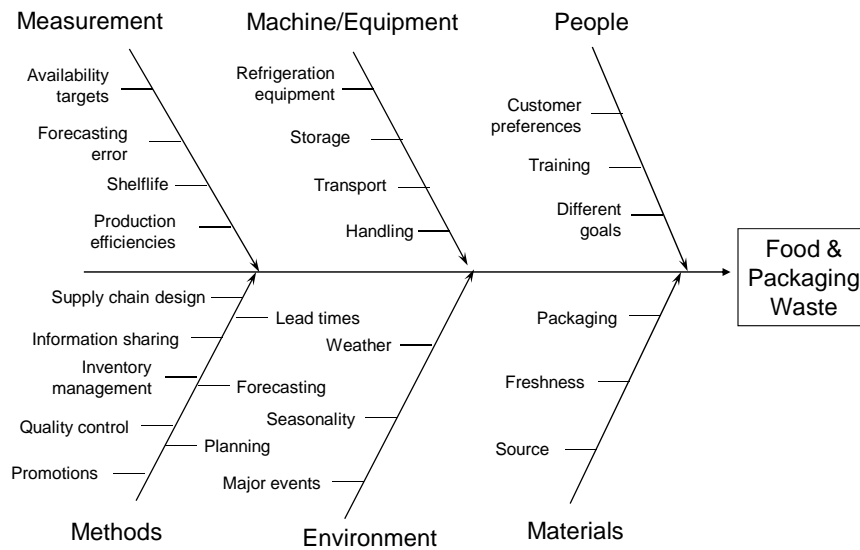
The UK government's Waste and Resource Action Program (WRAP⁴, 2010) has probably been the most effective in terms of showing that legislation is not necessarily the best way to champion a reduction in waste and an increase in environmental sustainability (Barnes, 2010). Begun well ahead of the UK recession, with a target of generating £1.1B (~ CAD\$1.78B) in financial benefits for industry and consumers by 2011 (WRAP, 2010b), the WRAP initiative began in earnest with the signing of the Courtland Commitment in 2005, an initiative to reduce packaging and waste through industry collaboration. With 12 initial signatories, by the end of 'Phase One' in March 2010, the Courtland Commitment had 42 signatories. Together the signatories represent 92% of the grocery retail sales and many of the world's major brands. The agreement has resulted in a 670,000 tonne reduction in food waste and a 520,000 tonne reduction in packaging between 2005 and 2009. This was in spite of a 2% growth in the grocery sector each year. "Many big brands and retailers have embraced this agenda, recognizing the commercial benefits. Less waste means less cost." (Dawe, 2010).

A government-supported partnership between the Institute of Grocery Distribution (IGD) and Cranfield University has also been instrumental in encouraging a move among commercial businesses to reduce waste. Targeted at farmers and small businesses, the "Sell More, Waste Less" program guides managers through the process of physically walking the value chain, then analyzing the performance of the operations to identify the causes of waste. **The "Sell More, Waste Less" program found that it is common for businesses to be able to reduce costs by 20% and increase sales by 10% through making improvements in the way their chains were managed.**

Figure 3 is a tool that Cranfield University devised to assist businesses in identifying causes of food waste. Called a 'cause and effect fishbone', it leads stakeholders from along a value chain to come to a common understanding about the causes of waste, then address the findings through implementing new processes and procedures.

⁴ WRAP UK works with businesses and organizations to reduce waste, develop sustainable products and use resources in an efficient way (WRAP website).

Figure 3: Cause and Effect Fishbone, Food Waste



Changing Consumer Behaviour

Supported by the WRAP program in particular, retailers and suppliers have introduced initiatives specifically designed to reduce waste by motivating changes in consumer attitudes and behaviours when making purchasing decisions and at home.

Purchasing Behaviour

The concept of offering consumers better value, while simultaneously creating less waste in non-food items by encouraging changes in purchasing decisions, has taken a number of forms.

An example of an innovative retail initiative designed to foster consumer loyalty while simultaneously reduce waste is the new form of BOGOF (*Buy One, Get One Free*) trailed by Tesco on select fresh fruit and salad items (Tesco, 2010). Instead of having to purchase both items at once, consumers were offered a coupon that allowed them to get their 'free' product within two weeks of the initial purchase. The program was purposely aimed at the growing demographic of smaller households that are not always able to consume the 'free' fresh products before they need to be disposed of. Tesco's success with the program comes through appealing to a segment of the market that historically did not benefit from volume related offers, thereby increasing its potential market share. The environment wins through the program reducing the level of waste associated with BOGOFs.

Warburtons, a UK-baker known for its innovative flair, introduced a program specifically designed to reduce food and packaging waste through offering smaller pack sizes. They identified a need among smaller households for a small loaf of bread that still offered full-sized slices. Introduced in 2008, the 600g loaves were so well received that the range has since been expanded (Warburtons, 2010).

As packaging can influence consumers' purchasing behaviours, retailers and suppliers are working together to encourage consumers to look beyond whether the packaging is plastic. Examples include developing re-sealable or re-usable packaging for products as diverse as all manner of breads, ham, cheese and meat. ASDA (*the UK subsidiary of Walmart*) has expanded packaging innovations into non-food items and is currently testing in-store vending stations that allow consumers to refill pouches of fabric conditioner (Goldstein, 2009).

At Home Behaviour

The development of programs designed to change consumers' at-home behaviours initially came from a WRAP study that identified inconsistencies in the information conveyed by retailers and suppliers, which confused consumers to the point that they wasted food unnecessarily. The study identified that, while the vast majority of the products sampled (96%) displayed some form of storage instructions on the packaging, there was variation in the guidance given. The study also found that it was rare for packages to offer storage advice that would help to prolong the contents, such as keeping opened meat in an airtight container, or that products could be frozen (either in the original packaging or after transferring to a suitable container).

In conjunction with WRAP, most grocery retailers have launched in-store programs to help consumers avoid unnecessary waste. In addition to providing food in more functional packaging, as described above, Sainsbury's and Morrisons are among the retailers who have introduced materials designed to educate consumers on how to best store food once at home. Both retailers also provide free in-store and on-line recipes for using leftovers in preparing tasty nutritious meals (Sainsbury's, 2010; Morrisons, 2010).

Conclusion

An enormous amount of food is wasted unnecessarily in Canada. The negative impact this waste has on our economy and environment is significant. While the majority of food waste occurs at the consumer level, improving the management of agri-food value chains would have the greatest long-term impact on reducing food waste, and the resulting economic and environmental impacts.

Canada trails Europe in terms of encouraging the changes in behaviour required to increase businesses' profitability by reducing waste. The agri-food sector trails other industries in seeking to increase its competitive advantage through adopting value chain management practices. Both factors, along with the examples presented, show that clear opportunities exist for Canadian agri-food chains to achieve competitive advantage through working together more effectively, particularly as the economy and the environment are on the minds of almost all consumers. Achieving these outcomes relies on effective leadership at the federal and provincial levels of government, and industry organizations, as well as on business managers proactively responding to the opportunities that undoubtedly exist.

References

Anonymous; (2009); Marc Bolland: When food packaging can reduce climate change gases; The Independent; Thursday, 14 May 2009.

Anonymous; (2010a); Personal Communication; Canadian Retail Executive

Barnes, Rachel (Editor) (2010). *A NEW ERA OF RETAILING: Taking responsibility: seizing the opportunity*; The Grocer. September 2010. Viewed online October 2010 at: http://www.wrap.org.uk/downloads/Grocer_Supplement_Sept_2010.d2e73242.9854.pdf

Brook Lyndhurst and ESA (2010). *Helping Consumers reduce food waste – a retail survey*; WRAP UK. August 2010. Viewed online October 2010 at: http://www.wrap.org.uk/retail/case_studies_research/report_helping.html

Canadian Processor. (2010). Confidential discussions with a senior representative from Canadian processor; October, 2010

Carbon Trust (2010). Carbon Reduction Label hits £2bn consumer goods landmark. 13 October 2010. Viewed online October 2010 at: <http://www.carbontrust.co.uk/news/news/press-centre2010/2010/Pages/carbon-reduction-label-consumer-goods-landmark.aspx>

Dunne, T. (2008). Value Chains: Insights From Australia; Webinar; Canadian Farm Business Management Council; <http://www.agriwebinar.com/Webinar.aspx?id=e8b6071a-78e6-4c8e-8515-2a5114be209f>

Fearne, A. F. (2007). *Reasons for Alliance Failure*; Value Chain Management: Adding Value to Agriculture; George Morris Centre, DVD

Fearne, A. (2009). Private Communication; Professor of Food Marketing and Supply Chain Management; Kent Business School

Food Chain Centre (FCCa) (2007). Applying Lean Thinking to the Produce Industry; Food Chain Centre

Food Chain Centre (FCCb). (2006). Cutting Costs – Adding Value in Cereals; Food Chain Centre

Fortescue, S. (2006). Bowland 'Em Over. *The Grocer, Dairymen, an editorial supplement to The Grocer*, September 9, 26.

Foster, C, Green K, Blenda M, Dewick P, Evans B, Flynn A, Mylan J (2006). *Environmental Impacts of Food Production and Consumption: A report to the Department of Environment, Food and Rural Affairs*. Manchester Business School. Defra, London. Viewed online at:

<http://www.ifr.ac.uk/waste/Reports/DEFRA-Environmental%20Impacts%20of%20Food%20Production%20%20Consumption.pdf>

George, R. M., P. J. Burgess and R. D. Thorn (2010). *Insights around the domestic refrigerator: Reducing food waste through the chill chain*; WRAP UK. Viewed online October 2010 at: http://www.wrap.org.uk/downloads/Summary_report_-_reducing_food_waste_through_chill_chain.3ce6eb6e.9621.pdf

Goldstein, S (2009). *Asda set to trial refillable packaging*; Packaging News. July 13, 2009. Viewed online October 2010 at: <http://www.packagingnews.co.uk/news/environment/asda-set-to-trial-refillable-packaging/>

Gooch, M, Marenick, N. Fefel, A. (2010). *Doubling Your Profits in 18 Months Through Value Chain Management*; Value Chain Management Centre; George Morris Centre. July 7, 2010. Available online at: <http://www.vcmtools.ca/pdf/Think%20Piece%20Lean%20Wkshp%20070710.pdf>

Gooch, M., Laplain, D., Stiefelmeyer, K., Marenick, N., Fefel, A., Ingratta, F., Martin, L., Siren, C., Lamb, T., Dent, B., MacTavish, J.; (2009). *Consumer Market Research Strategic Study for Fresh Grapes and Fresh & Processed Apples & Tender Fruit & Orchard Fruit & Vineyard Quality Assessment throughout the Value Chain*. Value Chain Management Centre; George Morris Centre. Available online: <http://www.vcmtools.ca/pdf/Vineland%20Final%20111009.pdf>

Gooch, M., Fefel, A.; (2009). *Characterizing the Ideal Model of Value Chain Management and Barriers to its Implementation*; Value Chain Management Centre; George Morris Centre. July 31, 2009. Available online at: <http://www.vcmtools.ca/pdf/The%20ideal%20value%20chain%20122109.pdf>

Gooch, M., LaPlain, D., Fefel, A. (2009a). *Adding Value to Pork*; Value Chain Management Centre; George Morris Centre

Gooch, M., LaPlain, D., Fefel, A. (2009b). *Adding Value to Lamb*; Value Chain Management Centre; George Morris Centre

Hughes, N.; (2010). *Why is the UK so rubbish at recycling? Try the label for size*; The Grocer; September 25, 2010.

Kuyk, A. (2010). *Food and Drink Federation*; United Kingdom

Lovefoodhatewaste website (2010). Viewed online October 2010 at: <http://www.lovefoodhatewaste.com/>

Macdonald, N (2009). *What a waste*, Macleans. Viewed online October 2010 at: <http://www2.macleans.ca/2009/11/09/what-a-waste>

Morrisons Website (2010). *Great Taste Less Waste*. Viewed online October 2010 at: <http://www.morrisons.co.uk/food/Recipe-inspiration/Great-Taste-Less-Waste/>

National Oceanic and Atmospheric Administration (NOAA); (2008). Carbon Dioxide, Methane Rise Sharply in 2007; April 23, 2008; http://www.noaanews.noaa.gov/stories2008/20080423_methane.html

Quested, T and Johnson H (2009). *Household Food and Drink Waste in the UK*; WRAP UK. November, 2009. Viewed online October 2010 at: [http://www.wrap.org.uk/downloads/Household food and drink waste in the UK -_report.d1131c44.8048.pdf](http://www.wrap.org.uk/downloads/Household%20food%20and%20drink%20waste%20in%20the%20UK_-_report.d1131c44.8048.pdf)

Sainsburys Website (2010). *Love Your Leftovers*. Viewed online October 2010 at: <http://www2.sainsburys.co.uk/food/mealideas/leftovers/waste.htm>

Saunders, C., Barber, A. (2007). Comparative Energy and Greenhouse Gas Emissions of New Zealand's and the UK's Dairy Industry; Agribusiness and Economics Research Unit; Lincoln University; New Zealand

Shimizu, H., Desrochers, P. (2010). "Will buying food locally save the planet?" Montreal Economic Institute, Economic Note, February 16.

Statistics Canada (2010). Human Activity and the Environment: Annual Statistics 2009. Viewed online October 2010 at: <http://www.statcan.gc.ca/pub/16-201-x/2009000/part-partie1-eng.htm>.

Tesco plc (2010). Tesco says "BOGOF" to Food Waste. 20 January 2010. Viewed online at: <http://www.tescopl.com/plc/media/pr/pr2010/2010-01-20/>

Value Chain Management Centre (VCMC) (2010). Statistics provided confidentially via industry managers.

Weber, C.L. and H.S. Matthews (2008). *Food-Miles and the Relative Climate Impacts of Food Choices in the United States*; Department of Civil and Environmental Engineering and Department of Engineering and Public Policy, Carnegie Mellon University. *Environ. Sci. Technol.*, 2008, 42 (10), pp 3508–3513. April 16, 2008. <http://pubs.acs.org/doi/abs/10.1021/es702969f>

Warburtons (2010). http://www.warburtons-trade.co.uk/your_shop/products/ and [http://www.wrap.org.uk/downloads/CC Case Studies 19 Aug 2010 final1.51c27ea0.6249.pdf](http://www.wrap.org.uk/downloads/CC%20Case%20Studies%2019%20Aug%202010%20final1.51c27ea0.6249.pdf)

Waste and Resource Action Program (WRAP). (2009). *Household Food and Drink Waste in the UK*; http://www.wrap.org.uk/downloads/Household_food_and_drink_waste_in_the_UK_-_report.f059c06d.8048.pdf

Waste and Resource Action Program (WRAP). (2010a). *Household Food Waste*; http://www.wrap.org.uk/retail/food_waste/index.html

Weston, G. (2009). *Presentation on Trends, Challenges and the Future of the Food Sector*. 14th annual Agricultural Adaptation Council Annual General Meeting, December 3, 2009, Guelph.

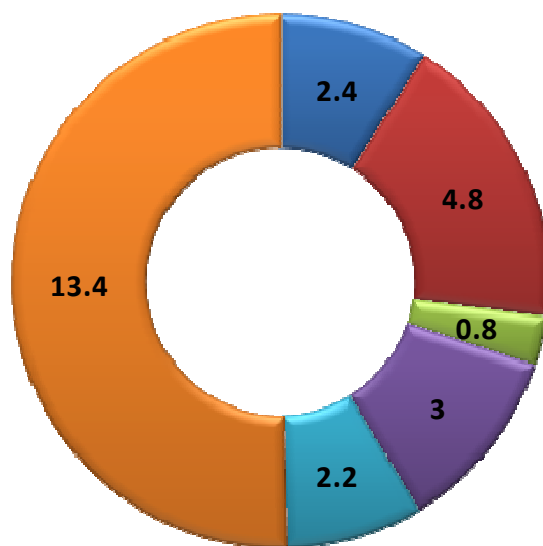
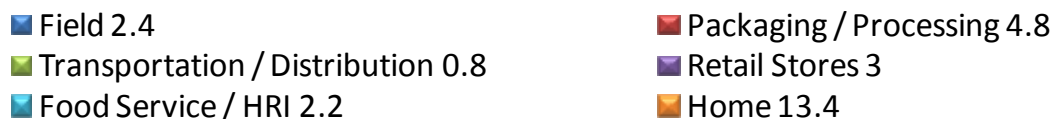
Womack, J.P., Jones, D.T. (2005). *Lean Solutions*. New York: Free Press

WRAP (2010)b. <http://www.wrap.org.uk/>

Zahrnt, V (2010). Based at European Centre for International Political Economy, Mr Zahrnt is the Editor of ReformtheCAP.eu website, viewed online at: <http://www.reformthecap.eu/search/node/food%20security>

Appendix A: Breakdown of the \$27 Billion in Food Wasted Annually in Canada

\$ Value of Food Waste Throughout the Chain (field to home) in Canada (billions)



We have estimated the waste in Canadian agri-food chains to be \$26.6 billion. This estimate is in line with another study⁵ that found nearly 40% of all food produced in Canada is wasted. This equates to \$32 billion, which is about 2% of Canada's GDP.

The estimate was based on consultations with industry stakeholders, along with additional secondary information. The industry stakeholders advised that the average percentage of unrecovered waste from field to retailers is as follows:

- Average waste at the field is 5% of the volume produced. However, the waste at the field varies greatly from one crop to another. Waste at the field is minimal in grain production and is about 10-15% in fruit and vegetable production
- Average waste during processing and/or packaging is 10%
- Average waste during transportation and distribution is 2%

⁵ <http://www2.macleans.ca/2009/11/09/what-a-waste>.

We consider the above percentages of waste as lost sales. In order to calculate the value of waste from field to retailers, we multiplied the above percentage of waste by sales of agricultural products in 2009, which was estimated at \$48.7 billion by Statistics Canada⁶.

The average waste at retail was estimated based on Loblaw's announced annual waste figure of \$1 billion. Loblaw's retail market share is about 33%. Summing up, it is realistic to estimate that the food waste at retail sector (DCs and retail stores) is \$3 billion.

The average percentage of waste at food services/HRI was estimated based on consultation with industry stakeholders who advised us that a well-run restaurant operation would have no more than 5% of food wasted. This would account for normal breakage, spills, overcooked food, etc. Uneaten food was estimated to account for a further 5%. We calculated the value of 10% waste at food services/HRI by multiplying this percentage by \$22 billion – the amount Canadians spent on food purchased from restaurants in 2008⁷.

According to Statistics Canada⁸, "In 2007, the loss of solid food was estimated at more than 6.0 million tonnes between retail level and the plate – the equivalent of 183 kg per person. Another 2.8 billion litres of liquids, including milk and milk products, coffee, tea, pop and juices, were also wasted. These losses do not include losses at the production level or during food processing." The cheapest kg of solid food is about \$2/kg and the cheapest litre of liquid is about \$0.5/L. This means the minimum value of the waste from retail to plate is \$13.4 billion.

⁶ <http://www40.statcan.gc.ca/l01/cst01/agri111a-eng.htm>.

⁷ Statistics Canada (2010), Survey of household spending (SHS), household spending on food, by province and territory, annual

⁸ Statistics Canada (2010), Human Activity and the Environment: Annual Statistics 2009. <http://www.statcan.gc.ca/pub/16-201-x/2009000/part-partie1-eng.htm>.