



Cut Waste, GROW PROFIT

How to reduce and manage food waste, leading to increased profitability and environmental sustainability

<http://georgemorris.org/foodwasteforum2012>

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To register for the November 19, 2012, **‘Cut Waste, Grow Profit’** forum
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While the VCMC has verified the secondary data presented in this report wherever possible, it gives no guarantee that the data provided by Statistics Canada and other statistical services, peer reviewed papers, websites or other sources are accurate.

1 Introduction

Food waste is a critically important issue. The Food and Agriculture Organization of the United Nations estimates that **one-third of food produced for human consumption (1.3 billion tons) is wasted along the food chain annually (2011). In Canada alone, an estimated \$27 billion of food is wasted annually** (Gooch *et al*, 2010). Its reduction is of vital importance to the Canadian agriculture and food industry, the environment and the economy in general.

People do not purposely waste food. The food waste that occurs in Canada is largely a symptom of current processes and attitudes, primarily of abundance and affluence. Ahead of the forthcoming **November 19, 2012, 'Cut Waste, Grow Profit'** forum, this background document identifies causes of food waste along the value chain. It describes a number of current initiatives aimed at reducing food waste, internationally and in Canada. The report ends by presenting examples of projects undertaken by the Value Chain Management Centre team that have reduced food waste by millions of dollars.

The techniques required to deliver economic and environmental benefits from the reduction of food waste already exist. Proven initiatives include the UK's **'Waste and Resource Action Plan (WRAP)'** and **'Sell More – Waste Less'** program, along with retailer-led programs such as **Marks & Spencer's 'Plan A'**. US initiatives include the **'Food Waste Opportunities and Challenges'** program, developed by the *Grocery Manufacturers Association* and *Food Marketing Institute*. Canadian and USA retailers, along with food manufacturers, are among those participating in the **'Consumer Goods Forum's Sustainability Pillar'** led by Tesco and Unilever. Compared to the scale and impact of these initiatives, Canadian efforts to reduce food waste are considerably less.

The forum is not about reinventing the wheel; it is about learning, adapting and improving current approaches to best suit the Canadian environment. It will illustrate that it is only through the implementation of value chain management approaches, the development of strategic alliances between businesses, that waste can be minimized along the entire food value chain.

Confirmed speakers include:

- Michael Bloom, Vice President, Organizational Effectiveness and Learning, Conference Board of Canada
- Martin Gooch, Director, Value Chain Management Centre
- Richard Kingdom, Managing Partner, InStride Solutions; Logistics Advisor, Second Harvest
- Maria Klimas, Senior Project Manager, Sustainability Consulting, Guelph Food Technology Centre
- Dan LaPlain, Associate, Value Chain Management Centre
- Ralph Martin, Loblaw Chair, Sustainable Food Production, University of Guelph
- Claudia Schmidt, Research Associate, George Morris Centre
- Shelley Stone, OGC Manager, Ontario Gleaners
- Andrew Telfer, Manager of Sustainability, Walmart Canada
- Anne Tennier, Vice President, Environmental Affairs, Maple Leaf Foods
- Ingrid Von Cube, President and Creative Director, Appetizingly Yours
- Michael VonMassow, School of Hospitality and Tourism Management, University of Guelph
- Keivan Zokaei, Visiting Professor, University of Buckingham; Associate, S A Partners (UK)

2 The Impact of Food Waste

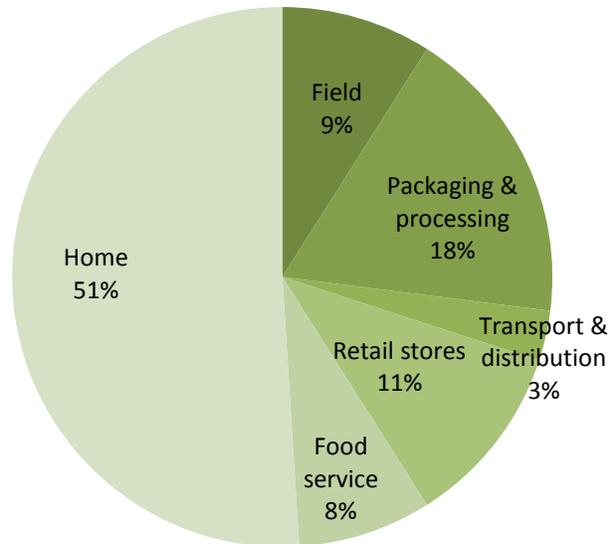
Stated in very simple terms, food waste is the loss of food along the value chain that is suitable for human consumption, or will be fit for consumption after processing – such as wheat. It occurs at various stages along the food chain from farm to consumers (FAO, 2011). The majority of food waste does not occur on the farm. It is an outcome of a lack of interconnectivity between activities from harvest through transport, processing, marketing, preparation, and the final choices made by consumers about whether to consume or dispose of the food (Hodges *et al*, 2010). The importance of tackling food waste goes beyond the food itself. It extends to the significant amounts of money and other resources invested throughout the lifecycle that are also lost when food is wasted (Buzby and Hyman, 2012).

2.1 How much is wasted?

Estimating the true amount of food waste is very challenging. Nevertheless, a 2011 global report estimated that **nearly one-third of all edible food produced for human consumption is lost or wasted**. This amounts to an estimated 1.3 billion tons per year (FAO, 2011). **To put this in perspective, the entire world's grain production for 2011/12 is estimated at 2.3 billion tons** (WAOB, 2012). Most troubling about the massive volumes of food we waste is that it could help compensate for the needs of those who do not have enough: **“Globally, there are roughly 50% more people who are overweight and obese (1.2 billion) than there are malnourished (860 million)”** according to a study published by the Stockholm International Water Institute (Lundqvist *et al*, 2008, p.19).

Food waste costs North Americans billions of dollars. Buzby and Hyman (2012) estimated that in 2008, the value of food wasted at the retail and consumer levels in the US was \$165.6 billion. This amounted to approximately 124 kg of edible food per capita. According to Statistics Canada (2010) estimates, in 2009, Canadian food waste at the retail and consumer level amounted to approximately 122 kg per person for total fresh and processed fruits and vegetables, 6 kg for dairy products, 10 kg of poultry (boneless) and 16 kg of red meats (boneless), and 18 kg of oils, fats, sugar and syrup^[1]. In Canada, Gooch *et al* (2010) estimated that \$27 billion of food is wasted each year, the largest body of waste occurring among households. The proportion of food estimated to be lost along the Canadian Food Value Chain (FVC) breaks down as follows:

^[1] These numbers have been calculated from Statistics Canada's Food Statistics (2010) by deducting the total food available adjusted for losses for each food group, from the food available for each food group. The adjustment factors that Statistics Canada uses to estimate food losses accounts for “losses at the retail and consumer levels, including institutions, restaurants and households. The factors attempt to account for losses or waste from storage, in the preparation of food and from the plate. The factors were provided, with appreciation, from the United States Department of Agriculture” (Statistics Canada, 2010, p.40).



Source: Gooch *et al*, 2010

Waste occurs along the entire food chain, from farmers and manufacturers down to supermarkets, restaurants and consumers. We are all responsible. To gain some insight into how and why food losses occur at such high rates, the following section provides an overview of the journey food makes from gate to plate and the losses associated with each link along the value chain.

2.2 Where is Food Being Lost?

While some losses are inevitable, the extent of waste in the agri-food sector is likely higher than in any other industry. Most losses are due to a lack of coordination between activities occurring along the value chain (Gooch *et al*, 2010). Studies show **between approximately one-quarter and one-third of agricultural output never reaches the consumer for whom it was grown** (Prusky, 2011; FAO, 2011).

Although food is lost throughout the FVC, it should be noted that there is quite a contrast in where food is lost between developed and developing areas in the world¹. "In low income countries, the majority of food losses generally occur on and near the farm. In contrast, most food losses in higher income countries occur [well] beyond the farm-gate" (Escaler and Teng, 2011, p.2). In medium and high income countries, food waste is mainly thought to occur at retail, foodservice and among households (FAO, 2011).

There are six main areas where food is lost through the chain: on the farm, during processing, through distribution, at retail locations, in food service, and by consumers.

¹ Most of the information presented in this report focuses on more affluent societies in North America and Europe.

2.2.1 The Farm

At the farm level, the majority of waste occurs post-harvest due to inadequate sorting, incorrect handling and storage, lack of correct storage technology, or due to spillage and degradation during handling or transportation from farm to further processing facilities (Escaler and Teng, 2011; Prusky, 2011; FCC, 2005). As shown for example by the Food Chain Centre (2006a), losses associated with mechanical damage during harvest or the incorrect use of harvesting equipment can also be significant.

Farm-related losses are due to over-production relative to the capacity of farm and FVC facilities to appropriately handle it and a lack of connectivity to downstream elements of the FVC. These include retail product quality standards, contractual penalties, product take-back clauses and the impact that poor demand forecasting has on production decisions (Parfitt *et al*, 2010).

Regulatory standards also play a role in farmers' production decisions. For example, **the government of Canada's Fresh Fruit and Vegetable Regulations include schedules for grading and standards of fruits and vegetables offered for sale, some of which may exclude marketing of food that is perfectly safe, but that does not meet size, shape, or colour standards** (Government of Canada, 2012).

Farmers also face pressure from buyers in deciding what and how much to plant. Retailers can change buying decisions on short notice. Market conditions are another key contributor to food waste at the farm level. If market prices are too low at the time of harvest, growers may leave crops in the field because the cost of harvesting exceeds what they will earn from selling them. Losses can also stem from growers over-producing in case extra quantities are required at short notice or if speculating on higher prices (Parfit *et al*, 2012; Gunders, 2012).

If the FVC worked more effectively, many of the points raised above would be addressed through there being greater coordination between and within business, in relation to how market demands can be satisfied most efficiently.

2.2.2 Processing

The food processing industry has been identified as the second largest contributor to food waste. Escaler and Teng (2011) state that in the UK: "The food and drink manufacturing and processing sectors produce an estimated 20% or 3.2 million tonnes of food waste per year".

Losses occur when crops are graded, washed, peeled, sliced and boiled or during process interruptions and accidental spillage. Food processors generate most losses through inaccurate or inconsistent trimming and culling, particularly when the raw inputs (crops or livestock) are of inconsistent quality (FCC/RMIF, 2005; Food Chain Centre, 2006b). "Culling is the removal of products based on quality or appearance criteria, including specifications for size, color, weight, blemish level and Brix" (Gunders, 2012, p.8). Similar to farm level production, some of the waste that occurs in food processing is due to specific requirements of buyers, or changing their purchasing decisions at short notice. Issues are exacerbated when products developed for "supermarkets' own brand, packaged surplus production cannot be sold elsewhere and become waste" (Parfit *et al*, 2012, p. 3072).

2.2.3 Distribution

Food waste during distribution is attributed to improper handling, packaging, or damage during transport. Examples include produce that is kept at improper temperatures, such as when it sits too long on loading docks, and imported products that wait for days at the ports for testing, significantly reducing their shelf life. Ineffective communication with customers and suppliers also leads to unnecessary food waste (FCC/RMIF, 2005; Food Chain Centre, 2006a/2006b).

The biggest source of waste at the distribution phase is the rejection of perishable shipments that are often dumped (Gunders, 2012). As shown by Gooch *et al* (2009), the food waste that can occur at distribution centres is often due to the suboptimal harvest, cooling and handling of perishable products such as fruit as it passes along the FVC. However, it is important to note that transport and distribution accounts for ‘only’ approximately 3% of the food wasted along the chain (Gooch *et al*, 2010; Escaler and Teng, 2011).

2.2.4 Retail

Poor communication, including a lack of meaningful data being shared between businesses operating along the FVC, leads to over-production and/or over-ordering (Escaler and Teng, 2011; VCMC, 2010). So too does the untimely sharing of information, due to the pressure that it can place on suppliers to prepare, process and distribute shipments (Taylor & Fearn, 2006). Retailers ordering products without giving sufficient consideration to how changes in the weather will influence consumers’ purchasing patterns also leads to higher levels of waste (FCC/RMIF, 2005). Through a series of studies carried out in the UK’s red meat industry, FCC/RMIF (2005) showed that demand amplification, where the sharing of inaccurate information between businesses leads to steadily progressive and extreme fluctuations between demand and supply along the value chain, is a particularly common cause of food waste occurring between processors, distributors and retailers.

The causes of these anomalies are: firstly, each business along the value chain – or separate functions of the same business (e.g. marketing vs. operations or procurement) – acting in isolation because it does not possess the information required for it to make informed decisions; and secondly, incentive systems that lead to ineffective management decisions (VCMC, 2010; FCC/RMIF, 2005). The negative impact of severe fluctuations in demand versus supply can reach back to the producers, resulting in increases of on-farm waste.

In-store food losses in the US totaled an estimated 43 billion pounds in 2008, or 10% of the total food supply at the retailer level (Gunders, 2012). A paper by the Value Chain Management Centre (VCMC) showed that losses in UK retail stores can be higher than 11% (2010). Where small food retail establishments are concerned, waste is estimated to be even higher because small grocery stores tend to be used by consumers for top-up shopping, which makes demand unpredictable (Parfit *et al*, 2012). A large portion of food lost at convenience stores are ready-made foods. **According to Gunders, convenience stores discard approximately 25% of their food products (Gunders, 2012).**

Other reasons for food waste at the retail level include management practices that create unnecessary levels of food waste having unexpectedly high inventories, due to corporate or store

managers incorrectly planning for seasonal promotions, or the incorrect handling of products (Gunders, 2012; VCMC, 2010; FCC/RMIF, 2005).

Food marketing has also played a significant role in encouraging wasteful consumer behaviour. Coupons, 'buy one get one free' offers, and super-sized portions encourage consumers to buy more than they need (Hodges *et al*, 2010; Gunders, 2012). Retailers operate under the practice that customers prefer to buy from fully stocked, towering displays, which leads to over stocking and over handling by staff and customers. This behaviour damages items at the bottom and shortens shelf life (Gunders, 2012).

As we move toward a more affluent society, the trend for pre-prepared convenience food is growing. Left unaddressed, it is conceivable that food waste among retailers could rise in coming years.

2.2.5 Food Service

Waste in the food service industry occurs in restaurants, hotels and institutions (such as school, hospitals and penitentiaries). It is largely attributable to quality standards and over-serving, (referred to as "plate waste"). **"On average, [US] diners leave 17% of meals uneaten"** (Gunders, 2012, p.11). Evidence documented by Gunders suggests this is partly due to increases in portion sizes: "From 1982 to 2002, the average pizza slice grew 70% in calories, the average chicken Caesar salad doubled in calories, and the average chocolate chip cookie quadrupled. Today, portion sizes can be two to eight times larger than USDA or FDA standard serving sizes" (Gunders, 2012, p.12).

Although it is possible to incorporate unused food into new meals, many food service outlets such as fast food restaurants preclude it due to uniformity standards in menus (Gunders, 2012).

2.2.6 Consumers

Consumers are thought to be the largest contributors to waste along the food chain (Gooch *et al*, 2010; Griffin *et al*, 2009; Parfitt, 2010; FAO, 2011; Segre, 2012). Reasons include excess purchases, cooking too much, failure to consume before perceived expiration date and improper storage. Purchasing higher amounts of perishable foods during holiday periods and not eating leftovers are also important causes of food loss at the household level, particularly in more affluent societies (Buzby and Hyman, 2012).

These reasons aside, the primary contributor to consumer food waste is high expectations. Growing demand for high quality, aesthetically-pleasing food has been identified as a key factor behind the volume of food waste that occurs among consumers (Hodges *et al*, 2010; Prusky, 2011).

The trends cited above have led to an undervaluing of foods. "In the USA, over a period of about 80 years (1929-2008), food expenditures by families and individuals as a share of disposable income decreased from 23.4 to 9.6%" (Hodges *et al*, 2010, p.42). In developed countries, a lower percentage of disposable income is spent on food. Subsequently, this can lead to individuals not placing a high value on utilizing what is purchased compared to consumers in developing

countries (Gunders, 2012). Seasonal factors also influence levels of food waste. For example, Buzby and Hyman (2012) found that more food is wasted by consumers in summer. Among consumers there is also a general lack of knowledge and understanding regarding food safety and preparation. Many are confused about label dates and believe they indicate a product's safety. Other reasons for increases in food waste include a trend away from in-home food preparation and meal planning (Escaler and Teng, 2011). This may lead to impulse and bulk purchases that are beyond households' requirements.

2.3 What are the environmental impacts of food waste?

The environmental impacts of food waste are just as troubling as the quantity of food lost along the FVC. There are two main environmental issues created by food waste: wasted resources and the environmental impact of refuse. Food production is resource intensive and consequently has significant environmental impacts. According to Lundqvist *et al*, (2008), food relegated to landfills generates harmful greenhouse gasses such as methane and carbon dioxide.

Most food waste finds its way to landfills, composters and incinerators. In the US, food waste represents the largest proportion of waste occupying landfills: around 35 million tons in 2010, according to the EPA (EPA, 2010). In the UK, recent estimates indicate that its carbon impact of food waste exceeds the equivalent of 20 Mt of CO₂ equivalent emissions (Parfitt *et al*, 2010). **The decomposition of organic waste in landfills also produces methane (Environment Canada, 2010), a greenhouse gas with a global warming potential that is 20 to 25 times higher than carbon dioxide.**

Concerns relating to food waste extend to the environmental impact that stems from the unnecessary use of natural resources to replace wasted product. Resources used in food production include arable land, feed, water, medications, fertilizer, chemicals, labour and energy. Many of these are non-renewable (Buzby and Hyman, 2012). Some of the most common environmental externalities associated with farming include energy used to manufacture N fertilizer, air pollution from machinery and transport fuel, ground water contamination due to runoff from crop inputs and crop protection chemicals, as well as soil erosion and the production of methane (Parfitt *et al*, 2010, Buzby and Hyman, 2012; Garrett, 2007). Hall *et al*, 2009, estimated that **the average US farm requires 3 kcal of fossil fuel energy to produce 1 kcal of food (prior to export for processing), and wasted food accounts for an estimated 300 million barrels of oil per year.**

The predominant resource used in agricultural production and the greatest concern relating to food waste the world over is water. "Agriculture is the largest human use of water" (Lundqvist *et al*, 2008, p.4). Hall *et al* (2009) stated that **70% of the freshwater supply in the US is used for agricultural production and estimated that more than one quarter of that water is accounted for by wasted food.** "Unlike water used in industry, the high proportion of consumptive use in agriculture means that this water is effectively lost for re-use or recirculation in society, that is, until it returns as precipitation" (Lundqvist *et al*, 2008, p.11). With rising incomes and urbanization, demand for food and key inputs such as water will increase further still (Lundqvist *et al*, 2008).

3 Efforts to Reduce Waste Along the Food Value Chain

There are very few necessities more essential for sustaining human life than food. As mentioned in previous sections, much of the food wasted along the FVC and the subsequent impact upon the environment is avoidable. With sustainability initiatives becoming a priority for developed and developing nations alike, **it is not surprising that reducing food waste has been termed ‘the next frontier of recycling’** (Bauers, 2012).

Reducing food waste over the long term will be an immense challenge, requiring a large number of changes in business strategies, national policies and coordination at the federal, provincial and municipal levels of government and within industry.

The strategies most likely to be successful are those that make economic sense and therefore a business case exists for reducing food waste (Buzby, 2012). Potential benefits exist for stakeholders situated along the entire FVC. For farmers, agri-food businesses, retailers and foodservice operators, it leads to financial benefits including reduced operating costs and increased revenue. Ways to reduce costs include eliminating disposal costs and improved logistical and management practices. Additional revenue can come from being recognized as an ethical organization (Segre, 2012). For consumers, the financial benefits that come from reducing food waste can be enormous. For public administration agencies, efforts to reduce waste can cut down on the amount of food going to landfills (and the associated transportation and handling costs), and result in better management of funds.

Beginning at the farm level, producers’ production decisions offer significant potential for reducing food losses further down the chain. Prusky, 2011, p.466, stated that: “The potential final market value of produce depends on the grower’s decisions on what to plant and when, and on subsequent cultivating and processing practices”. Opportunities to reduce waste at the farm level are also attainable by shortening the FVC by connecting farmers directly to consumers (Prusky, 2011).

During food processing, opportunities exist for re-purposing and thus downgrading food losses into other productive inputs. At the distribution stage, productive recycling or redistribution of surplus into animal feed, or to produce energy through anaerobic digesters and composting could represent better, more efficient, and cost saving measures (Escaler and Teng, 2011; Hodges *et al*, 2010).

A few of the ways retailers can work to reduce food waste is by employing information technology to improve their demand forecasting techniques (Escaler and Teng, 2011), evaluating their marketing practices and helping to communicate how food should be stored/handled to staff and shoppers. They can also divert food waste from landfill by segregating it into categories, targeted at specific uses/outcomes. In foodservice, establishments can work to reduce food waste by engaging in menu planning, portion size control, balancing carbohydrate foods with others, and employing more creativity for utilizing surplus ingredients that would otherwise be discarded.

The key to avoidance is planning and implementation. **To curb food losses during the pre-consumer phase of food production, the chain must work together more effectively and efficiently to understand and deliver value to the market while also managing resources to minimize waste in the first place.**

As consumers are the biggest wasters of food, they possess perhaps the greatest potential when it comes to limiting food waste. Encouraging changes in consumer behaviour relies on education campaigns and placing greater emphasis on home economics skills (Escaler and Teng, 2011).

3.1 UK Initiatives

3.1.1 WRAP

The Waste Reduction Action Programme (WRAP) is a leader in the area of food waste reduction. Launched in 2000 by the UK government, this program has led and overseen a plethora of food waste reduction efforts throughout the UK. It should therefore come as no surprise that the UK is home to a significant number of waste reduction projects.

Retailers can reduce their own food waste as well as encourage consumers to reduce the amount of food wasted in their homes. In the UK, over 40 major retailers, brand owners, manufacturers and suppliers have signed the Courtauld Commitment, launched in July 2005. The participants have committed to reduce both post-consumer packaging and post-consumer food waste through innovative packaging and optimal choice of volume of the product, in-store guidance and a consumer campaign (ECDGE, 2008, p.64). **Among households alone, WRAP's efforts have led to an estimated 18% reduction in avoidable food waste.**

3.1.2 Sell More – Waste Less

The Institute of Grocery Distribution's (IGD) 'Sell More – Waste Less' program was purposely designed to assist businesses along the FVC, from farmers through to retailers and foodservice, to benefit financially through curbing food waste. It does this in part by helping them identify the root causes of waste. IGD delivers workshops in conjunction with Cranfield University. It also offers free online resources to help farmers and small businesses increase sales and reduce food waste by making more effective planning and general management decisions. To encourage uptake among industry, it has developed a series of case studies that describe how business owners and managers have benefited financially from the courses and materials.

3.1.3 Plan A

Large retailers can have the greatest impact on determining which food waste strategies are adopted by suppliers. Aimed at making all of their UK and Irish operations carbon neutral by 2012, UK retail giant Marks & Spencer launched its 'Plan A' project in 2007. Plan A's goal is to reduce waste and maximize the use of renewable energy along the FVC, and only use offsetting as a last resort. The initiative has led to significant reductions in carbon emissions as well as financial benefits for both Marks & Spencer and its suppliers.

Tactics for helping customers and suppliers cut their carbon emissions include: sourcing as much food as possible from the UK and Republic of Ireland; launching five research and development

projects to develop production systems for crops not normally grown in the UK; improving coordination along the food chain through the application of lean management techniques; and working with the Carbon Trust to identify carbon 'hot spots' in their food chain and setting targets to reduce CO₂ emissions.

3.1.4 ASDA

ASDA is the UK grocery chain owned by Walmart. Finding ways to reduce, or divert food losses into productive inputs enables retailers to reduce their operating costs. ASDA set out to become a 'zero waste to landfill' business by using their supply chain network to deliver an operationally and commercially viable process that avoids incurring landfill costs. They began by developing new processes to segregate food into three categories: animal by-products, bakery, and other food waste. The segregated waste is then transported via ASDA's reverse logistics to an ASDA recycling centre, where food is used for anaerobic digestion, and bakery waste, where possible, is used for pet food. **To date, ASDA reports that significant financial savings have been realized, and 25,000 tonnes of food waste has been processed through anaerobic digestion facilities and therefore diverted from landfill** (IGD, n.d.).

3.1.5 Booker and Walkers Snack Foods

Effective communication between suppliers along the FVC enables food waste to be reduced significantly, leading to comparative increases in profit. The increased financial performance of Booker and Walkers Snack Foods has also come from the associated reductions in financial costs that were achieved through establishing more effective lines of communication. Booker and Walkers identified that poor communication between factories and regional distribution centres was leading to a high incidence of product shortages. It also resulted in some branches being overstocked and experiencing high levels of waste. To correct this problem, Booker and Walkers' central supply chain team worked closely together to determine if each branch had the correct number of drops per week and altered delivery profiles accordingly. As a direct result of forecasting and replenishment changes, Booker and Walkers saw an increase in their products' on-shelf availability, an increase in sales **and an 80% drop in their annual landfill waste** (IGD, n.d.).

3.1.6 Morrisons, "Great Taste, Less Waste"

Arming consumers with the information they need to make smart food choices is another effective way of reducing food waste. British retailer, Wm Morrison Supermarkets Plc, introduced their national "Great Taste Less Waste" campaign, aimed at reducing the amount of food that UK consumers throw away each year. One of their measures was to employ packaging that extended the shelf life of produce by keeping it in good condition for longer. They also added 'Best Kept' labeling instructions for consumers to ensure that produce is properly stored in the home for longest life. Morrisons is also helping promote effective meal planning through multiple recipe suggestions that use the same ingredient(s) (WRAP, 2012).

3.1.7 Premier Foods

This company began a 'Great Little Ideas' consumer website in 2010. The site provides hundreds of recipe ideas and practical hints and tips to help inspire families to try something new and encourage greater use of leftovers. 'Great Little Ideas' helps consumers make their shopping budget go further and, simultaneously, reduce food waste. This in turn helps the environment

too. The website has 30,000 signed up users and receives about 125,000 visitors each month (WRAP, 2012).

3.1.8 Molson Coors Brewing

Food waste is known to increase during important holidays, such as Thanksgiving and Christmas, yet little attention has been given to this issue, let alone proposing ways to address it. Inspired by research showing that curry internet searches peaked on Boxing Day, as households looked for ways to reinvent Christmas Day leftovers, UK operations of Molson Coors Brewing introduced new recipes, created by a celebrity chef, that perfectly complement their beer. Molson Coors launched 'Ultimate Boxing Day Leftovers' curry menu, aimed at eliminating waste over the festive period and increasing beer sales (WRAP, 2012).

3.1.9 Hospitality and Food Service Agreement

While signatory agreements to address specific issues are typically employed by groups of countries, or inter-governmental organizations, businesses can also use them to affect positive change. In an effort to cut food waste in the service industry, 73 hotels, pubs, restaurants, fast food restaurants, caterers and government departments signed the Hospitality and Food Service Agreement, committing to cut waste by 5% by 2015. The voluntary agreement (launched by WRAP) is committed to increasing to 70% the overall rate of food and packaging waste that is being recycled, sent to anaerobic digestion or composted (GRD, 2012).

3.1.10 Food Date Labelling

Research by WRAP identified that consumers were being confused by packaged food that carries multiple dates, such as "sell by", "use by" and "display until". Consequently, the UK government has begun revising its guidelines on food date labeling of "sell by" and "display until" labels, with retailers being urged to explore different ways of tracking and controlling stock. **"Best before" dates relate to food quality, including taste, texture, and appearance, but do not indicate that eating product past that date will be harmful. "Use by" dates relate to food safety. Food may not be sold after the "use by" date, but retailers can, with the exception of eggs, sell products after the "best before" date, provided they are safe to eat (Gunders, 2012).** Likewise, the European Commission has started to work on food waste and is currently in the process of analyzing how to minimize food waste without compromising food safety through stakeholder platforms and setting up a data base on good practices in food waste reduction. This work will feed into the Communication on Sustainable Food to be adopted in 2013 (WRAP, 2012).

3.1.11 Buy One Get One Free – Later

Price elasticity is the term given to describing that lower prices incentivize consumers to buy more. 'Bogof' (buy one get one free) offers are one of many marketing tactics that encourage consumers to purchase more than they need. To counter the wasteful effect of such promotions while delivering value to its customers, Tesco now offers 'buy one get one free – later' or 'Bogofl' (Poulter, 2009). Consumers are required to purchase the second item within two weeks. Since the introduction and success of the Tesco scheme, from a corporate responsibility and economic perspective, other UK retailers have followed suit.

3.2 US Initiatives

3.2.1 Farmers Markets

Food waste reduction efforts in the US have focused on shortening the FVC and developing community food programs, designed to divert food waste from those who have too much to those who have too little. Farmers' markets in the US, which have more than doubled in number in the past 10 years, allow growers to sell good quality products that might not meet size, shelf life, or other criteria imposed by retailers (Gunders, 2012).

3.2.2 Food Rescue and Good Samaritan Laws

An important characteristic of food waste reduction efforts in the US is the business climate in which it operates. "The US business environment is favourable towards food redistribution because there are tax incentives to do so, there is legal protection from Good Samaritan laws, and it can help improve corporate image" (Stuart, 2009, referenced by Hodges *et al*, 2010).

The existence of tax incentives and Good Samaritan laws has led to a plethora of charity-based food redistribution efforts in the US. One interesting example is the Society of St. Andrew Potato and Produce Project, which salvages tractor-trailer loads of potatoes and other produce that are rejected by commercial markets due to slight imperfections, and redistributes these to food banks, soup kitchens, Native American reservations, food pantries, low income housing areas, local churches and other hunger agencies for distribution to the poor. The Society of St. Andrew is headquartered in Virginia, but has regional offices in Alabama, Florida, Georgia, Mississippi, North Carolina and Tennessee.

3.2.3 Grocery Manufacturers Association and Food Marketing Institute

The Grocery Manufacturers Association and Food Marketing Institute have recently started a coalition focused on tackling food waste with an aggressive strategy that will send more edible food to the hungry and move food waste from landfills toward productive uses such as animal feed, waste-to-energy and composting. The three-year effort is expected to result in better understanding of these challenges, identifying best practices, new technologies and emerging solutions to reduce and repurpose food waste, as well as formulating policy proposals that will make food donations to the hungry more streamlined and effective.

3.2.4 Trayless Cafeterias

The level of social consciousness that exists at many universities makes them well-poised to initiate food waste reduction efforts. Institutional food service leader, Sodexo, now operates trayless cafeterias on more than 300 college campuses in the US (Gunders, 2012). Similarly, the University of California Berkeley's dining services is using LeanPath software to identify waste sources and reduce pre-consumer waste by 43%, saving more than 1,000 pounds of food and \$1,600 per week (Gunders, 2012).

3.2.5 Environmental Protection Agency

Government-led initiatives are also important tools to usher in new values and behaviour. The US Environmental Protection Agency has recently launched its Food Recovery Challenge, which targets businesses and challenges them to think about their input use. The Food Recovery Challenge aims to help businesses reduce costs by helping them improve purchasing and

preparation practices and reduce waste disposal fees, support their community by using food to feed people, not landfills, reduce their environmental footprint and greenhouse gas emissions, and access free technical assistance for baseline assessment and food recovery activities.

3.2.6 Half-Off Promotions

Placing a new twist on an old marketing tactic is one way to move more products while saving shoppers money. As identified previously, Bogof (buy one get one free) is one of the marketing tactics used by retailers to encourage consumers to purchase more. To counter the potentially wasteful effect of such promotions while continuing to deliver value to its customers, the Co-operative Group supermarket chain has begun running half-off promotions (Gunders, 2012). This negates the need for consumers to potentially buy beyond their needs in order to enjoy a 50% reduction in price.

3.3 Canadian Initiatives

Food loss reduction initiatives in Canada have mostly been driven and enabled by private business and non-for-profit organizations. While a number of them have received government support, the investment of public monies has largely been piecemeal and the outcomes of initiatives not connected to reducing food waste.

3.3.1 Community Food Pantries / Food Banks

Community food pantries are becoming increasingly visible in Canada as a means to redistribute excess food to those in need. The Montreal Urban Community Sustainment (MUCS) group's Zero Food Waste Network rescues surplus food from local businesses and redistributes it to local food security organizations (MUCS, 2012). Unfortunately, this organization ceased operation since May 2012 and could not be consulted at the time of this review.

3.3.2 Environmentally Accountable Food Service

Some organizations help businesses achieve more sustainable practices including ways of reducing waste. Restaurants and other food service establishments across Canada can now receive green restaurant certification, recognizing their use of environmentally-friendly practices from Leaders in Environmentally Accountable Food Service (LEAF). Certification criteria are based on international standards and scientific data, focusing on 10 areas of sustainability including: energy use, food purchasing, supplies, building location, furnishings and decoration, chemicals, waste and recycling, employees, policy innovation, and water use (LEAF, 2012).

3.3.3 I Dream in Green

Large institutions where food is served have the opportunity to not only cut waste and save money in the process, but also to disseminate cultural values through environmentally-friendly initiatives. In the fall of 2008, Aramark launched its "I Dream in Green" campaign on college and university campuses in an effort to bring more sustainable cafeteria fare to students and staff across Canada. Initiatives included the introduction of bin programs for waste, recycling and compost (Aramark, 2012).

3.3.4 Waste Reduction Week

Education and awareness initiatives are essential for curbing food waste at its largest source in Canada – households. **In 2012, a coalition of 13 recycling councils and sister organizations from across Canada have joined forces to launch ‘Waste Reduction Week’ from October 15 - 21, 2012.** As a part of this week, food waste reduction events include ‘Waste Free Lunch’, challenging elementary schools across the country, and also recycling campaigns to benefit local food banks.

3.3.5 Consumer Choice

Commentators and authors have proposed an array of options to help consumers reduce food waste in the home, for example Mayer (2012) and Vernile (2011). They include:

- Taking stock before shopping, to ensure that consumers are not overstocking on perishable food in particular;
- Planning out meals over the week, and buying accordingly;
- Buying perishable foods at regular intervals during the week, rather than as bulk items;
- Checking expiry dates when making food choices in the store;
- Not assuming that buying in bulk is always the better option;
- Ensuring that portions are being calculated and served correctly;
- Freezing then reusing leftovers when a suitable opportunity arises;
- Thinking before tossing out overripe fruit and vegetables – they can, for example, be used in smoothies or baked goods;
- Never shopping on an empty stomach, to reduce the drive to buy on impulse; and
- Ensuring that the refrigerator is not crammed full, to help ensure that food does not get forgotten.

3.4 Waste Reduction – Canadian Regulatory Framework

An effective waste reduction framework is one that must focus on waste reduction and that can be implemented by each link in the production chain. “Waste prevention is a horizontal action taking place in all steps of the material flow, over extraction, production, distribution, consumption, waste and end-of-waste phases. Waste prevention cannot be limited to one stage. However, the higher the stage in the material chain the prevention measures are taken, the more effect they have on all subsequent stages” (ECDGE, 2008, p.21).

Although Canada has a well-developed regulatory system for diverting recyclable materials, there are virtually no regulations referring directly to organic waste, which includes food waste. The emphasis in waste reduction in Canada is focused more on recycling, reusing and reducing refuse. However, there are a few general regulations that touch on a food waste component, including regulations related to waste audits.

Businesses who wish to receive recognition for their commitment to reducing waste can do so through non-profit organizations and through marketing claims. For example, the Recycling Council of Ontario (RCO) offers a 3R certification aimed at the industrial, commercial and institutional sector to provide credibility and recognition toward achieving environmental goals. The RCO is an independent third party evaluator charged with verifying and validating

organizations' sustainability claims. The verification process involves on-site assessments based on objective performance standards and compliance measures (RCO, 2012).

In Canada, obtaining an environmental certification for a product is not regulated by the government. Rather, non-profit environmental stewardship organizations can allow businesses to use their seal of approval if the good or service meets their requirements (CSA, 2008). Environmental sustainability claims in Canada generally fall under 12 categories; however, none of the categories accurately represents efforts to reduce food waste. Nor can such claims be made on products produced or sold in Canada because the concept is deemed to be too general and unverifiable: "The concepts involved in sustainability are highly complex and still under study. At this time there are no definitive methods for measuring sustainability or confirming its accomplishment. Therefore, no claim of achieving sustainability shall be made" (CSA, 2008, p.11).

3.4.1 Example: Ontario Regulations

The present situation in Ontario illustrates why food waste reduction initiatives will continue to be driven by private initiatives, where sufficient economic incentives exist.

In the Province of Ontario, municipalities of more than 5,000 residents are required to offer leaf and yard waste and composting systems and encourage the use of home composting under Regulation 101/94 Recycling and Composting of Municipal Waste (Government of Ontario, 2011). However, collection of other organic, or "green waste", such as food and other compostable household waste, remains at the municipality's discretion. Similarly, source separation programs for businesses, including restaurants, food retailers, food manufacturing facilities and institutions where food is served or produced, focus solely on recyclables. Regulations relating to waste and source separation programs from industrial, commercial and institutional premises include Ontario Regulation 103/94. This incorporates provision for aluminum, cardboard, glass, newsprint, polyethylene, and steel, but does not include organic waste, where restaurants (or any other businesses or institutions) are concerned.

Waste audits are mandatory on an annual basis for Ontario businesses that meet size thresholds (Government of Ontario, 1994). Ontario Regulation 102/94 Waste Audits and Waste Reduction Work Plans also requires business owners of manufacturing and retail establishments and restaurants, for example, to develop a plan to reduce, reuse and recycle waste. The audits can be self-performed by the business owner or operator, or outsourced at larger establishments. The Waste Reduction Work Plan must be posted for employees. There is no requirement to submit proof of an audit to the Ministry of Environment, but the Ministry may enter the establishment and request to see the posted Plan.

A food and beverage facility is required to conduct an annual waste audit if the amount of hours worked by employees at the site exceeds 16,000 hours during any month of the previous two years. Requirements of Regulation 102/94 stipulate that a waste audit must be conducted that includes: the quantity, type and composition of all waste in the facility; that the audit report must provide details of how waste is produced and how it is being managed; and, that a waste reduction plan, explaining how to deal with the reduction, reuse, and recycling of waste, be completed (Government of Ontario, 1994).

3.5 Waste Reduction Case Studies

Following are examples of three process improvement projects undertaken by the Value Chain Management Centre's team that led to improvements in businesses' profitability *and* benefited the environment. For reasons of commercial confidentiality, they are reported anonymously.

3.5.1 Reducing Spills

Business A is the producer of pre-cooked frozen entrees. On a fish entree production line, there was a substantial amount of seafood on the floor every day. Beyond the costs associated with the wasted seafood, the company had to pay overtime for clean-up and additional costs for disposal of the spillage. Management perceived the spill points as unimportant because the low cost of labour (minimum wage) offset wasted ingredients and the company was profitable. On the line, workers saw the seafood as a luxury item and felt management were insulting them by throwing it away. This lessened their motivation to address the problem and work to their best ability. Fixing the spill points saved the company about \$150k per year and allowed them to pay the workers a bonus. This resulted in further savings and increased productivity.

Business B is an international ice cream manufacturer. They experienced a problem with tub weight variation and higher consumption of additional ingredients than which had been budgeted. Processes such as sanitation and HACCP were well documented, but the set-up and operation of key equipment was left to operator judgment. Furthermore, the physical controls of key equipment were old and sub optimal. \$30k was spent installing a proper HMI (human-machine interface) and a best practice operator handbook was developed and implemented. In just five months, savings from over consumption of ingredients, tub overfill or top ups and increased production amounted to \$230k.

3.5.2 The Relationship Between Grower and Processor

Business C is a significant manufacturer of frozen French fries for the quick service restaurant sector. They were paying a premium for what they had assumed were potatoes with specific attributes. Upon careful examination of key manufacturing lines, it was determined that the premium attribute was actually a detractor and resulted in downgraded products. The production of premium potatoes placed a strain on natural resources and caused increased energy consumption in the production process.

With greatly improved process knowledge, the premium specification was changed to focus on consistency. The improved state resulted in higher conversion rates, significantly reduced energy costs, and reduced environmental impact along with increased production of premium product. Coming together with producers to identify best practices led to on-farm improvements that reduced produced costs and provided additional long-term environmental benefits. The financial benefits that the processor and producers accrued from the project through reductions in wasted food and other resources were significant.

4 Conclusion

Amidst increasing concerns about the environment, a burgeoning population and global economic woes, the sustainability of the food industry and its ability to successfully address future challenges is under question. However, a significant proportion of the food we produce is wasted. **The current situation does not only create enormous unnecessary costs for businesses and consumers, it creates enormous environmental challenges.** The issue of food waste has therefore rightly captured the attention of businesses, governments, environmental and social welfare organizations, academics, the media and consumers.

This report defined food waste as the loss of food produced for human consumption, which occurs at various stages of the food chain from field to landfill. For Canada alone, the estimated annual cost of food waste is approximately \$27 billion. According to Statistics Canada (2010) estimates, in 2009, Canadian food waste at the retail and consumer level amounted to approximately 122 kg per person for total fresh and processed fruits and vegetables, 6 kg for dairy products, 10 kg of poultry (boneless) and 16 kg of red meats (boneless), and 18 kg of oils, fats, sugar and syrup.

Immense challenges will be faced in developing the policies, legislations, regulations and business practices required to minimize the amount of food wasted along the food value chain (FVC). Although the vast majority of food is wasted in the home, the report highlighted six sources of food loss: on the farm, during processing, through distribution, at retail locations, in food service, and by consumers. The amount of food wasted by consumers and along the FVC is exacerbated by ineffective short-term management decisions.

Initiatives to reduce food waste have been executed by businesses situated along the FVC and wider industry. These include charitable organizations, environmental stewardship groups, private businesses, and in some cases national and inter-governmental organizations. The UK currently leads the way in terms of the extent to which private business and government have supported initiatives targeted at reducing food waste. The most successful initiatives undertaken in the UK and elsewhere have been those that have communicated the business (economic) case for reducing food waste.

In Canada, to date, initiatives aimed at reducing food waste have been largely intermittent, isolated and driven by industry or not-for-profit organizations. The leadership, by and large, has not come from government. The Canadian regulatory system offers little incentive for businesses to engage in organic and food waste avoidance or reduction. All businesses, including food manufacturing and service providers are required to conduct waste audits and waste reduction work plans mandated and enforced by the provincial government in Ontario. In Canada, achieving a more sustainable food system and reducing current levels of waste will rely on better coordination occurring between all members of the FVC, and be driven by economic incentives.

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