



Case Studies on

Food Loss and Waste

in North America



Post-harvest
Food Production



Food Processing



Distribution



Retail



Foodservice

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Table of Contents

1	Introduction.....	1
2	Case Studies.....	1
2.1	Source Reduction of Food Loss and Waste.....	1
2.1.1	<i>Approach 1 – Reducing Portion Sizes.....</i>	2
2.1.2	<i>Approach 2 – Increasing Marketability of Produce.....</i>	4
2.1.3	<i>Approach 3 – Standardize Date Labels</i>	5
2.1.4	<i>Approach 4 – Packaging Adjustments</i>	6
2.1.5	<i>Approach 5 – Improving Cold-Chain Management.....</i>	7
2.1.6	<i>Approach 6 – Value-Added Processing</i>	9
2.2	Food Rescue and Recovery	11
2.2.1	<i>Approach 1 – Increasing Rescue of Healthy Food</i>	11
2.2.2	<i>Approach 2 – Storage and Transportation Improvements.....</i>	16
2.2.3	<i>Approach 3 – Liability Protection for Donors.....</i>	18
2.2.4	<i>Approach 4 – Online Food Rescue Platforms.....</i>	19
2.2.5	<i>Approach 5 – Feeding Animals.....</i>	20
2.3	Measuring, Tracking and Reporting Food Loss and Waste	23
2.3.1	<i>Approach 1 – Waste Composition Analyses.....</i>	23
2.3.2	<i>Approach 2 – Diaries.....</i>	26
2.3.3	<i>Approach 3 – Surveys</i>	28
2.3.4	<i>Approach 4 – Models and Proxy Data Extrapolation.....</i>	29
2.4	Policy and Education/Awareness Programs.....	34
3	Appendix	44
4	Bibliography	45

1 Introduction

Food loss and waste (FLW) is an increasingly important issue in North America, where annually close to 170 million tonnes of food produced for human consumption are lost and wasted across the food supply chain. Food waste in landfills is a significant source of methane gas—a greenhouse gas (GHG) 25 times stronger than carbon dioxide. FLW also has environmental and socio-economic impacts, including: the inefficient use of natural resources, economic loss, biodiversity loss, and public health issues.

Across North America and internationally there are numerous examples of organizations working to reduce FLW through changes to their day-to-day operations or the creation of special programs. From businesses like food processors, restaurants and supermarkets, to public sector entities and nongovernmental organizations like food banks and food rescue operations, this booklet features some of the most noteworthy examples of FLW-related initiatives in Canada, Mexico, the United States and abroad. By creating innovative yet feasible and cost-effective programs, these organizations can inspire food industry businesses to develop their own money-saving programs to help mitigate FLW and rescue/recover surplus food.

The 36 initiatives in this series are featured in the Commission for Environmental Cooperation's 2017 foundational report, *Characterization and Management of Food Loss and Waste in North America*. Operating at various stages of the food supply chain, the selected organizations represent a diverse cross-section of private-sector companies, governments and NGOs. Each case study contains a description of the initiative's main features followed by a statement of its positive impacts and key insights. The case studies are compiled into four sections: Source Reduction of Food Loss and Waste; Food Rescue and Recovery; Measuring, Tracking and Reporting Food Loss and Waste; and Policy and Education/Awareness Programs.

2 Case Studies

2.1 Source Reduction of Food Loss and Waste

The case studies in this section focus on actions to minimize surplus food generation and prevent avoidable FLW generation. The six approaches applicable to the initiatives described here are:

- **Reducing Portion Sizes** to reduce plate waste and address over-serving, plate composition and tray use.
- **Increasing Marketability of Produce** to increase use of second-grade produce, adjust government and/or grading requirements, raise merchandising standards, and reduce shipments rejected.
- **Standardizing Date Labels** to reduce wasted food caused by confusion related to date labels through standardization and education of key players across the food supply chain.
- **Implementing Packaging Adjustments** to manage portion size and reduce damage during transport and increase shelf life.
- **Improving Cold-Chain Management** to avoid rejection of shipments due to spoilage and cold chain deficiencies related to infrastructure and management.
- **Expanding Value-Added Processing** to cultivate secondary markets for damaged or surplus food and byproducts.

2.1.1 Approach 1 – Reducing Portion Sizes

Case Study 1. Canada: Adapting Food-Ordering to Customer Needs / Neighbourhood Group of Companies

Food Supply Chain Stage: Foodservice – Restaurant

The Neighbourhood Group of Companies operates four sit-down restaurants in the City of Guelph, Ontario, that promote sustainable and locally grown and crafted foods and beverages. With 150 full-time and part-time employees, the restaurant chain is an active member of the community. The owner has undertaken a number of initiatives to understand how and where food loss and waste (FLW) is generated, and how to reduce FLW.

To understand how much waste was being generated, all kitchen and plated waste was measured over a three-month period. The results showed on average 0.6 kilograms of waste per guest, about 80 percent of which was FLW; the remaining 20 percent was recyclable materials or garbage. Of the FLW generated, 45 percent was kitchen FLW (e.g., vegetable cuttings, meat cuttings, eggshells) and the remaining was FLW from plated food.

The owner started to examine which dishes typically created FLW and how they were being prepared. The investigations revealed that the most common FLW in the kitchen was potato peelings from making mashed potatoes and the most common FLW on the plate was French fries. The owner responded to observations by eliminating potato peeling (i.e., by leaving the skins on the potatoes for mashed potatoes, potato salad and French fries), and by reducing French fry portions (see photo). In addition, the restaurants do not offer bread, since 40 percent is thrown out. Bread is provided to customers by request but it is not advertised.

After the success of the first FLW monitoring study, the owner initiated a follow-up project with the University of Guelph. The study showed that on average, 10 to 15 percent of plated food was coming back as waste; this was again dependent on the particular dish. For example, the item that generated the most FLW was the signature pulled pork served with side orders of mashed potatoes, bread, and coleslaw. This finding resulted in the owner's reducing the portion sizes of side orders, and now the dish produces negligible FLW. Condiments (e.g., ketchup) provided another example of observed FLW. Now staff ask customers if they want condiments and provide them in small bowls, which has reduced ketchup consumption by one third. Dessert portions were also identified as being too large and have now been halved in size, with the price reduced to reflect the change. This has resulted in a significant reduction in waste and a significant increase in the sales of desserts.

Positive Impacts: The owner has noticed overall savings in operating costs, both from reduced labor associated with food preparation (e.g., not having to peel potatoes) but also in food costs, making the restaurants more profitable now than before. Furthermore, the decision to support local foods and sustainable activities has resulted in greater growth in business and customer support.

Key Insights: There is a need to educate customers about FLW and to promote smaller portions and other waste-reduction initiatives in restaurants. Restaurants need to measure FLW in order to be able to identify opportunities to create less FLW and thereby increase overall savings for the business, by reducing portions.

Source: Interview C17.



Source: Neighbourhood Group of Companies 2016.

Case Study 2. Canada: Trayless Dining and Smaller Plates / Dalhousie University

Food Supply Chain Stage: Foodservice – Institutional

In 2007, Dalhousie University conducted an audit to investigate generation rates of food loss and waste (FLW) and discovered that at the university's largest cafeteria an average of 227 kilogram of FLW was generated per day. Of the FLW generated, just over half of it came from plate waste and the rest from the kitchen. At the time of the waste audit, the cafeteria used trays.

The waste audit results also showed that the greatest amount of post-consumer FLW was generated at dinner, and the least at lunch. On average, each student generated approximately 0.3 kilograms of FLW over the three meals.

When a survey was administered to the students who ate at the dining hall, 55 percent admitted to regularly leaving one quarter of the food on the tray as waste and 69 percent of respondents were aware of the fact that they were discarding uneaten food. Furthermore, 47 percent of students attributed poor food quality/taste to the main reason for the FLW and 33 percent admitted that their waste resulted from taking too much food. Almost all students surveyed (97 percent) were on a meal plan. When asked what could be done to reduce the amount of FLW generated, the most popular responses included increasing food quality and taste (38 percent responses), introducing controlled portion sizes and changing the type of meal plan provided.

Positive Impacts: In March 2008, almost one year after the waste audit, the university introduced trayless dining in all four of the residence dining halls. According to Aramark's Foodservice Director at Dalhousie, "Getting rid of trays is one of several environmentally friendly initiatives Aramark, the university's foodservice provider, is making these days. The move will also cut back on water and detergents used to clean and sterilize the 3,000 to 4,000 trays in circulation at Dalhousie each day." Aramark found that when it went trayless in universities and colleges, the amount of FLW was reduced by 25 to 30 percent. In addition to introducing trayless dining, the use of smaller dining plates has also now become standard practice. Aramark has replaced the larger 33-cm dinner plates with 23-cm plates, to further reduce plated FLW.

Key Insights: There are many opportunities to reduce FLW in the eating areas of campus dining halls and other large cafeterias, by implementing simple procedures such as trayless dining and use of smaller plates. Monitoring FLW in front and back of house is key to collecting the data to support change.

Sources: Wright 2007; Smulders 2008.



Source: Dalhousie University n.d.

2.1.2 Approach 2 – Increasing Marketability of Produce

Case Study 3. Canada: The Misfits Campaign / RedHat Co-operative

Food Supply Chain Stage: Food Production Post-Harvest

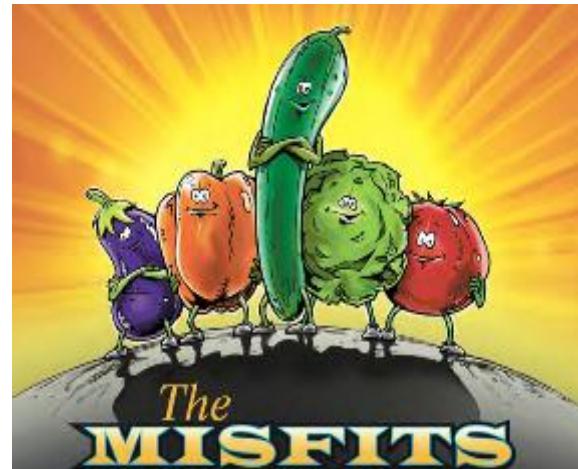
RedHat Co-operative is a farmer co-operative in Southern Alberta that specializes in greenhouse-grown vegetables. It has more than 50 growers who produce approximately 36,000 tonnes of vegetables per year. Of these vegetables, 3–5 percent are second-grade. Since the vegetables are grown in greenhouses, they need to be picked and cannot be tilled back into the soil. Without markets for these vegetables, they are typically disposed of.

In 2014, RedHat Co-operative launched The Misfits, a produce line which is based on the Inglorious Fruits and Vegetables program created by Intermarché, a major grocery store chain in France. Instead of culling its second-grade produce, RedHat packed the produce and sold it at a discounted price to wholesalers and grocery stores. The program began as a pilot in Calgary, Alberta, with two grocery chains (Safeway and Co-op) and one wholesaler (Freestone Produce) participating. A pilot is currently running with Save-on-Foods, in Regina, Saskatchewan. Save-on-Foods is planning to expand this program to 35 stores in Alberta. RedHat is also selling The Misfits to wholesalers and distributors, which includes providing vegetables to Loblaw's Naturally Imperfect produce line.

Positive Impacts: In the initial pilots alone, approximately 23 tonnes of vegetables were sold as The Misfits. Customers were excited about the products and most stores sold out. Farmers benefit from The Misfits as they are able to increase their income from vegetables that they would have otherwise not been able to sell. Farmer morale has also increased, as there is often a feeling of guilt associated with disposing of edible vegetables. Due to demand for The Misfits, RedHat Co-operative has expanded and started brokering second-grade produce from the US and Mexico, to supplement supply from its growers, especially of vegetables that cannot be grown in colder climates or during the off-season. One distributor from the United States, Robinson Fresh, has purchased a license for The Misfits brand and is scaling the program up to 400 grocery stores.

Key Insights: There is demand and interest for The Misfits from farmers, wholesalers and consumers; however, retailers are still slow to scale up and expand the program beyond running pilots.

Source: Meinhardt 2015.



Source: Meinhardt 2015.

2.1.3 Approach 3 – Standardize Date Labels

Case Study 4. United States: Food Recovery Act and Food Date Labeling Act / United States Government

Food Supply Chain Stage: Processing, Distribution, Retail

To address the dual issues of food loss and waste (FLW) and food insecurity in the US, Congresswoman Chellie Pingree led an initiative to develop two pieces of legislation: H.R. 4184 – Food Recovery Act of 2015, and H.R. 5298 – Food Date Labeling Act of 2016.

According to a joint study by the Harvard Food Law and Policy Clinic, the National Consumers League and the John Hopkins Centre for a Livable Future, 84 percent of Americans discard perfectly edible food. The “Food Date Labeling Act” addresses the issue of date/expiration label confusions, which is one of the most common causes identified by consumers for why they throw away otherwise perfectly edible food. The Act, which was introduced to Congress on 18 May 2016, would standardize terms used for date labeling nationally, and would prohibit states from preventing food retailers from donating safe foods that are past their best-before dates to charities.

“The Food Recovery Act of 2015,” introduced to Congress on 12 July 2015, complements the “Food Date Labeling Act of 2016” as it aims to promote and support food rescue at every stage of the food system (including farm, retail, school, military and even in Congress). The “Food Recovery Act” also seeks to promote more research on FLW prevention and reduction and on sustainable management of FLW, and proposes to develop a fund that will support infrastructural projects, to prevent wasted food from going to landfills. The “Food Recovery Act of 2015” was not enacted by the 114th Congress; it was subsequently reintroduced as two bills—S. 3108: Food Recovery Act of 2016, and H.R. 3444: Food Recovery Act of 2017. The “Food Date Labeling Act of 2016” was also not enacted by the 114th Congress and, as of the time of writing, has not been reintroduced.

Positive Impacts: Both of the proposed Acts will help support the national target to halve FLW in the country by 2030. While, at the time of writing, the two pieces of legislation have not been passed, they have generated discussion and brought attention to the issue of FLW in America. Celebrity chefs such as Tom Colicchio and diverse groups such as the Natural Resources Defense Council (NRDC), Rethink Food Waste through Economics and Data (ReFED), Harvard Food Law and Policy Clinic, and the Grocery Manufacturers Association (GMA) have all endorsed the bills.

Key Insights: The proposal of new legislation can bring more attention to the issue of FLW, even before it has been passed in Congress.

Source: Pingree 2016.



Source: Pingree 2016.

2.1.4 Approach 4 – Packaging Adjustments

Case Study 5. United States: Packaging Adjustments for Changing Lifestyles / Wegmans Food Markets, Inc.

Food Supply Chain Stage: Processing, Distribution, Retail

Wegmans Food Markets, Inc., is a private supermarket chain headquartered in New York, with 89 stores across the United States. Wegmans continues to be a leader in reduction initiatives for food loss and waste (FLW), in the food retail industry.

When Wegmans noticed a trend toward smaller household sizes, it recognized that customers were seeking to cook more efficiently at home. To meet its customers' needs and to reduce FLW, Wegmans adapted its food packaging to ready-to-eat or ready-to-cook individualized portions.

By sealing single-serving meat portions, Wegmans increased the shelf life of in-store meat and supported home FLW reduction, since customers are able to unseal one portion at a time for home preparation.

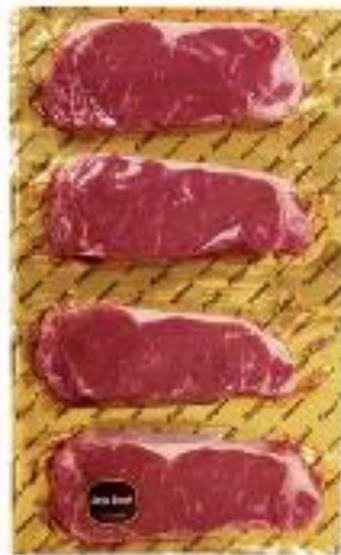
Previously, Wegmans sold bulk-packaged products at a discount, branded as "Club Pack" products. While the discount incentivized customers to purchase larger quantities, they would often waste the product at home. Wegmans shrank its "Club Pack" and rebranded it as a "Family Pack" in order to target the appropriate customers. In addition to reducing FLW, this initiative had the added benefit of educating consumers on portion sizes and on prioritizing quality over quantity.

Working with the chefs and food preparation staff in-store, Wegmans began to optimize blemished produce for ready-cut fruits and veggies, salads, and other prepared deli items. This practice resulted in the dual benefit of reducing "shrink" (or wastage) and offering time-saving healthy snacks to customers.

Positive Impacts: Some of Wegmans' initiatives have resulted in customers' purchasing smaller amounts of food. As a values-based company, Wegmans saw its first priority as serving its customers' needs at home, rather than encouraging higher quantities of sales and throughput. The company has been able to maintain its bottom line financially while using packaging adjustments to help reduce home FLW. What differentiates Wegmans from competitors is its holistic approach to diverting, preventing and reducing FLW. Wegmans also participates in the USDA's and EPA's Food Recovery Challenge. This commitment has translated into ideas to educate staff and into support for farmers by better purchasing and forecasting, as well as into collaboration with other retailers. The company has also reflected its focus on better measurement and tracking, by using the FLW Standard.

Key Insights: Adjusting packaging to reduce FLW in-store and at home may lead to less overall throughput but a financial bottom line can still be maintained. Wegmans' strong showing of value and commitment to customer service over sales numbers produces mutual benefits and demonstrates how a retailer can positively influence household FLW reduction. The challenge over time will be to seek ways to use easily compostable or recyclable packaging, in order to minimize overall waste generation.

Sources: Barnes 2015; Interview U39.



Source: Wegmans Food Markets, Inc. 2016.

2.1.5 Approach 5 – Improving Cold-Chain Management

Case Study 6. Mexico: Database of Cold-Chain Transportation / The Mexican Transport Institute (Instituto Mexicano del Transporte—IMT)

Food Supply Chain Stage: Distribution

The Mexican Transport Institute (*Instituto Mexicano del Transporte*—IMT), a branch of the Ministry of Communications and Transportation (*Secretaría de Comunicaciones y Transportes*—SCT), was created in 1987 to address aerial, terrestrial, maritime and rail transportation issues. The institute conducts field-based research, technology development, transport regulation, specialized services, training, technology and knowledge dissemination, and technical assistance.

The IMT built a database to serve as a central repository of data collected by the SCT. The dataset includes information such as the origin and destination of loads transported in the country, transport companies and individual truck owners, types of loads, and cost of transportation per kilometer.

The IMT also developed a methodology to identify cold-chain management needs in the country by tracking movements of perishable load and identifying those that need refrigeration. Using the information compiled in this database, regions of the country with cold-chain management gaps were identified—such as the southeast region.

Although this database produced preliminary results on cold-chain management coverage and gaps, there are uncertainties due to aspects such as inconsistent classification of loads. Furthermore, the database may not be representative of all transport in Mexico. Despite these potential uncertainties and data gaps, this database can help target efforts for increasing the coverage of cold-chain management in Mexico.

Positive impacts: The database tracked a number of metrics on cold-chain management in Mexico. Cold-chain management increased five times from 2005 to 2015, nationally, from 11,951 to 54,904 units. Of these units, 37 percent are owned by companies and 63 percent by individuals. The average age of the trucks is 14 years, for the company fleets, and 22 years, for the individual-owned. Cold-chain management is concentrated in Mexico, with 56 percent of all cold-chain transportation units located in only six states (Nuevo León, Sinaloa, Estado de México, Guanajuato, Sonora and Jalisco). The states with the highest number of cold-chain units were Nuevo León and Sinaloa, each with 12 percent of all units. Coverage of cold-chain management is generally weak in the southeast region, with minimal changes in coverage from 2005 to 2015.

Key Insights: Although the results may not show a representative sample of the entire country and the database is still being developed, the results of the analysis provided some relevant conclusions that can be considered in designing strategies to increase the cold-chain management in Mexico.

Source: Morales 2016.



Source: Maines Paper and Food Service, Inc. n.d.

Case Study 7. Mexico: Pineapple Storage Study / Mexican Transport Institute

Food Supply Chain Stage: Distribution

Cold-chain management is a crucial process for fresh products like pineapples, as it is the only preventive measure to slow ripening. To test the impact of cold-chain management, the Mexican Transport Institute conducted a study to evaluate two modes of packing fresh pineapples for export and compared the damage from each packing method.

In the first method, pineapples were harvested directly and then transported to the city without cold storage or packing. This is a practice medium-sized companies commonly use for exports. Unpaved roads often needed to be used to transport products from the field to the packaging center, which contributed to fruit damage. The processes of harvesting, handling, packing and storing also added damage to the product.



In the second method, packing was done in a field near a cold storage facility before transportation. The pre-transportation facility was less than two kilometers from the field, which resulted in significantly less product damage. The product was cooled shortly after harvest, which also extended shelf life.

The study found that a temperature of 12°C is required to maintain pineapples for export to an international market, taking into account one month of storage time prior to sale.

Positive Impacts: Using cold storage immediately after harvest extends pineapple storage life significantly and reduces damage that leads to wasted product.

Key Findings: The export of fresh pineapples in a rigorously controlled process with cold storage directly after harvest can result in lower fruit damage and extended shelf life.

Source: Torre 2008.

2.1.6 Approach 6 – Value-Added Processing

Case Study 8. Canada: Broken Ladder Cider / British Columbia Tree Fruits

Stage of Food Supply Chain: Post-Harvest, Processing

BC Tree Fruits is one of the largest fruit-growing farm cooperatives in Canada, with more than 500 member growers and 13 packing facilities. Their growers are based in the Okanagan region of British Columbia. The primary crops grown by their members include apples, cherries, peaches, and pears. The average annual gross production is approximately 77 million kilograms of fruit.

Of the fruit produced, approximately 80 percent is sold as fresh fruit. The remaining 20 percent is culled. Although there are markets for culled fruit, of which the majority is destined for juicing and animal feed, the prices for fruit that go to these end-uses are very low. To find a better use for culled fruits, BC Tree Fruits pursued the cider industry. BC Tree Fruits partnered with Lonetree Cider Company to produce a cider from culled fruit, called Broken Ladder. There are three recipes under this product line: Authentic Dry, Ginger Apple and Cranberry Apple Cider. This cider is marketed as a minimally processed, 100 percent BC fruit product, which appeals to a growing consumer demand for more locally made craft beverages.

Positive Impacts: In its initial rounds of production, BC Tree Fruits has repurposed 5 percent of its culled fruit for cider and is planning to increase this to 25 percent (approximately 5 percent of gross production) as production ramps up. Since the cider is produced under BC Tree Fruits, the profits go not just to the processor but also to the cooperative's member growers, which gives them a higher-value market for their fruit.

Sources: Interview C7; McLeod 2015.



Source: BC Tree Fruits Cider Co. n.d.

Case Study 9. United States: Just Peachy Salsa / Campbell Soup Company

Food Supply Chain Stage: Post-Harvest, Processing

Approximately 38,500 kilograms of peaches were disposed of annually by Eastern ProPak Farmers' Cooperative, mainly for aesthetic reasons. The peaches were either undersized or blemished and unsaleable at grocery stores. The cooperative was spending US\$80,000 in annual dumping fees to rid itself of perfectly safe, edible fruits.

Meanwhile, the Food Bank of South Jersey was faced with a growing food-insecure population, which required the charitable organization to distribute an additional two million pounds of food. To make matters worse, the Food Bank of South Jersey was threatened by funding cuts.

After discovering that perfectly edible peaches were being disposed of close by, the Food Bank of South Jersey purchased the peaches at a highly discounted price. However, the surplus of fresh ripe peaches was too much for the Food Bank of South Jersey to handle before they spoiled. The Food Bank of South Jersey contacted Campbell Soup Company (their regular donor) and came up with the idea of processing the peaches into peach salsa (which is a shelf-stable product).

In 2012, Campbell Soup Company, Eastern ProPak Farmers' Cooperative, Summit City Farms and the Food Bank of South Jersey partnered to create "Just Peachy Salsa" from otherwise wasted peaches. This case is a great example of a public-private partnership model. However, it should be noted that this solution might be challenging to scale up to other facilities that have processes that are more rigid and cannot be changed for a short period (peach harvest). Facilities with the ability to manufacture custom seasonal products would be able to take advantage of this type of opportunity.

Positive Impacts: With this innovative idea, the Food Bank of South Jersey was able to maintain its hunger relief programs while repurposing food that would have gone to waste. Campbell's donated the cost of manufacturing and packaging the salsa. In 2012, the Food Bank was able to make US\$100,000 in profit and in 2013, 52,000 jars of "Just Peachy" salsa were produced. This program benefited many stakeholders across the food supply chain, from farms to processors to consumers.

Key Insights: While the Food Bank of South Jersey found a way to connect with the Farmers' Cooperative to save the peaches from being thrown out and had a supportive donor who was willing to assist in processing the peaches, there are more fruits and vegetables that are not being saved and other farmers /food banks that do not have the same resources or networks. Raising awareness and corporate buy-in to reduce wasted food will allow other food-processing companies to utilize produce that is rejected by the retail sector to benefit the charitable sector.

Sources: Donnelly 2015; CSC Brands, L.P. 2013; Interview U37.



Source: CSC Brands L.P. 2013.

2.2 Food Rescue and Recovery

The initiatives detailed in this section focus on intercepting safe and edible surplus food otherwise destined for disposal. Food rescue and recovery is defined as actions to rescue safe and nutritious food first for human consumption and recover secondly for animal feed through receiving, storing, or processing, with or without payment, food, which would otherwise be discarded or wasted. The selected case studies demonstrate five distinct approaches to food rescue and recovery, including:

- **Increasing Rescue of Healthy Food** to capture second grade and other surplus food.
- **Storage and Transportation Improvements** to expand temperature-controlled food distribution and cold infrastructure for donated food.
- **Liability Protection for Food Donors** to protect donors from liability for donated food and to educate potential donors about related regulations.
- **Online Food Rescue Platforms** to match generators of surplus foods to buyers and charities.
- **Feeding Animals** to increase capture of nutritious surplus food or byproducts.

2.2.1 Approach 1 – Increasing Rescue of Healthy Food

Case Study 10. Mexico: Banco de Alimentos de México Rescues Nutritional Food / Banco de Alimentos de México (BAMX)

Stage of Food Supply Chain: Secondary Market

Started in 1995, *Banco de Alimentos de Mexico* (Food Bank of Mexico—BAMX) is a private, nonprofit association. With its first food bank located in the State of Jalisco, BAMX currently comprises a network of more than 60 food banks, in half the Mexican states, and operates a distribution center in the city of Tepeji del Río, in the state of Hidalgo. BAMX is also a founding member of The Global Foodbanking Network.

BAMX rescues food that is no longer marketable and is at risk of being wasted but is still suitable for human consumption. Food is distributed to food-insecure communities to reduce hunger and improve nutrition. BAMX rescues food from various parts of the supply chain, including distribution centers, food markets, food manufacturing facilities, supermarkets, hotels and restaurants.

By 2014, BAMX had rescued 117,094 tonnes of food and distributed it on a weekly or bi-weekly basis. In 2013, the total value of food transferred was P\$2.28 million. Almost 60 percent of the food distributed is fruits and vegetables, with the balance made up of grains, cereals and various proteins. BAMX distributes food to over one million people, representing close to 1 percent of the Mexican population.

More than 10,000 people work in the BAMX network; 46 percent are volunteers, 40 percent receive some in-kind payment, and the rest are staff and social service personnel. BAMX operates nationally and therefore acts as a single point of contact for donors, which more efficiently funds and supports



Source: Interview M44.

multiple food banks across Mexico. BAMX coordinates its network of food banks and has standardized methods for food distribution across regions, in order to increase efficiency and optimize the use of food donations. BAMX also provides operational training to its member food banks and coordinates the work force across the network. BAMX regularly conducts surveys of its clients, to ensure that they are being reached effectively.

In 2014, BAMX began construction of the National Center for Collection and Distribution (*Centro Nacional de Acopio y Distribución*—Cenadi), in partnership with the Ministry of Social Development (*Secretaría de Desarrollo Social*—Sedesol) and the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (*Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación*—Sagarpa). In 2015, the 3.8-hectare facility distributed 2,564 tonnes of food nationwide, covering 90 percent of the food bank network in Mexico.

Over 4,000 companies in Mexico donate to BAMX, and get receipts that can be used for a tax deduction for 5 percent of the donation's value. In addition to strengthening donation networks, BAMX also creates agreements with non-food businesses. These partners participate as part of their Corporate Responsibility programs and contribute volunteers, donated funds, leadership, and business services to strengthen the capacity of food banks. An added benefit to these partners is positive publicity from BAMX, through online and social media channels. Organizations, including CMR, the Bank of America and Merrill Lynch, participate in more in-depth partnerships to focus on specific projects, such as restaurant food rescue. Carl Junior's and partners have engaged to fight hunger by creating a donation program through their foodservice outlets. There is also a Social Food Rescue Program (*Programa Social de Rescate Alimentario*) that has rescued nearly 45,000 tonnes of fresh fruit and vegetables since 2011, from food from rural farmers.

Positive Impacts: In 2014, through the National Crusade for Hunger, via Sedesol and Sagarpa, BAMX obtained P\$237.5 million (US\$12.5 million) to strengthen the infrastructure of food banks and food rescue in the countryside. The resources were used in the construction of 10 food banks, a National Distribution Center (Cenadi) and the rescue of more than 18,000 tonnes of fruit and vegetables in the Mexican countryside.

Key Insights: While there are still labor and logistics issues that make increasing distribution challenging, a nationally funded and operated network of food banks has proven to be an effective way to rescue food from various parts of the food supply chain and deliver it to Mexico's food-insecure populations across the country.

Source: Interview M44.

Case Study 11. Mexico: A Centrally Located Food Bank in Mexico City / Food for All (*Alimento para Todos*)

Stage of Food Supply Chain: Secondary Market

Established in 1994 with the support of Caritas Arquidiócesis de México IAP, Food for All (*Alimento para Todos*) is the largest independent food bank in Mexico. Located near the Central Supply Market of Mexico City (*Central de Abasto de la Ciudad de México*—Ceda), Food for All rescues food from food loss and waste (FLW), along with electronics, clothes, shoes and other unused household items that have re-use value.



Source: Bergua 2016.

Ceda and supermarkets, food industries, bakeries and some restaurants are the primary food bank donors. Because Ceda's primary focus is fruits and vegetables, Food for All uses donations from the other organizations to compile nutritionally-balanced packages for distribution. For example, beans and rice are generally not donated and are purchased separately to balance the donation packages. Donors get a receipt for 5 percent of the donation value, in line with laws for tax deductions.

Over 82 staff and volunteers operate the food bank and are supported by a nutritionist, to ensure donation packages are balanced and best practices for food safety are followed. Since communities receiving rescued food send at least two volunteers each morning, maintaining production flow standards requires constant vigilance. Management systems are in place to keep up-to-date records on food inputs and where and how food gets distributed across socio-economic lines, as determined by partnering social workers. Food for All charges the recipient of rescued food 10 percent of the commercial value of the donations in order to maintain the perceived value of the food while also keeping the cost of the food minimal. Even without specific food handling regulations, regular audits are conducted by the *Junta de Asistencia Privada* (the board) and the food bank is visited regularly by the Commission for the Prevention of Sanitary Risks.

Positive Impacts: Food for All rescues and distributes approximately two tonnes of food weekly, to 32,000 people in vulnerable communities across Mexico City, Estado de México, Puebla, Morelos and Tlaxcala. Volunteers are critical to the success of the program and come from different companies, boy/girl scout groups, and schools. On average, 40 volunteers assist with the program daily.

Since 2014, Food for All and *Universidad Iberoamericana* (Ibero-American University) in Mexico City have organized an annual event called “Colloquium to reduce food insecurity,” where experts discuss topics on food rescue. In partnership with producers in Milpa Alta, efforts are underway to rescue 1–1.5 tonnes of edible cactus (nopal) in excellent condition. Lastly, Food for All worked with government institutions to strengthen the base of donation and more efficiently collect donations, through its exemption under the Not Driving Today Program (*Programa Hoy No Circula*).

Key insights: More awareness among the Ceda stand-owners would increase donors and beneficiaries for the food banks. Organizations such as Food for All work independently and do not have resources to access government support programs and tax incentives, to help offset operations expenses.

Sources: Interview M43; Alimento Para Todos IAP n.d.; Hoy No Circula 2016.

Case Study 12. United States: Nourish L.A. / L.A. Kitchen

Stage of Food Supply Chain: Secondary Market

The L.A. Kitchen began as a pilot project in 2013, modelled after the D.C. Central Kitchen, a nonprofit and social enterprise that uses rescued food for job training and distribution of healthy meals and snacks to areas with low food security. In 2015, the L.A. Kitchen opened a full-scale, 20,000-square-foot facility, acting as the primary tenant in the LA Prep food processing hub. The facility was funded through a combination of foundation grants and nonprofit loans, and includes space for training, storage, food

preparation, cooking, processing, and packaging. Currently there are 12 staff working at L.A.

Kitchen, along with 40 partner organizations for culinary training, food distribution, and volunteer programs.

Multiple programs run under the umbrella of L.A. Kitchen:

- Reclaim L.A.: Rescuing unsaleable produce from farmers and wholesalers
- Empower L.A.: Culinary training for foster youth and former prison inmates
- Nourish L.A.: Distribution of healthy food to social service agencies
- Engage L.A.: Intergenerational volunteer program for people to prepare food together
- Strong Food: Social enterprise fulfilling contracts for seniors' meals and value-added food products

Through Nourish L.A., healthy meals, snacks and food products created from rescued food are distributed to social service agencies in Los Angeles, including after-school programs, drug treatment centers, senior centers, and empowerment programs for homeless populations. Rescued food is delivered or picked up, and then transported to the L.A. Kitchen's facility for cold storage. At the facility, the staff works with nutritionists to develop predominantly plant-based non-perishable food products or meals that meet state and local regulations. Food is prepared by an integrated team of staff, culinary students, and volunteers in the health-code-approved processing space. Meals, snacks, and food products are packed in the cold packing room, for distribution.

Positive Impacts: By providing "from scratch, healthy, mostly local, good tasting food," Nourish L.A. is filling the increasing demand for free, low-price and reduced-price meals to vulnerable populations who want higher-quality and nutritious food. Nourish L.A. has a goal to provide 990,000 meals, snacks, and wholesale products to social service agencies each year. Nourish L.A. is also helping social service agencies save millions of dollars. This savings can be used for the agencies to further their programs instead of paying for foodservices.

Key Insights: There is a demand and need for integrated social services that offer healthy and dignified food to customers, not just food to fill bellies. Food rescue organizations can aspire to improve the quality of food and health of vulnerable populations, build job skills of people who have barriers to employment, and create a diverse community through volunteer programs that break down socio-economic silos.

Sources: L.A. Kitchen 2016; Interview U33.



Source: L.A. Kitchen 2015.

Case Study 13. United States: Affordable Grocery Store / The Daily Table

Stage of Food Supply Chain: Secondary Market

Founded by a veteran of the grocery industry, The Daily Table is a nonprofit grocery store that opened in June 2015 in Dorchester, Massachusetts, with a goal of using rescued and donated food from a variety of sources to offer low-cost food in underserved neighborhoods. One of the primary tenets of Daily Table's stated mission is to compete with other common, prepared-food and fast-food options by offering "ready-to-cook" and "grab-n-go" prepared meals at competitive prices. That includes selling healthy meal options at price

points to match fast-food alternatives and at the same time offering an upbeat and dignified retail setting. As part of that effort, Daily Table does extensive food preparation on-site, with cooks and sous-chefs, most of whom are local hires.

Still in a pilot phase and not yet self-sustaining, Daily Table founder Doug Rauch hopes to build sufficient scale and reduce costs of goods to meet their mission and cover costs. The enterprise is very clear in its intent to address two problems simultaneously: wasted food and food insecurity. Daily Table is located in a low- and middle-income neighborhood that suffers from the "food desert" effect of having difficulty attracting reasonably priced, healthy and nutritious food. Rauch says "Daily Table is really a health initiative masquerading as a retail store."

On the food-sourcing side of the operation, Daily Table receives donated or very-low-cost food from a variety of sources. The food includes items typically offered by food banks; supermarket extras; and produce from local farms collected by volunteer gleaning groups. Daily Table also purchases food at market rates, when it is needed to expand offerings or to fill recipe ingredients. About half of the food is donated and the other half is purchased, usually at very low cost.

Positive Impacts: The social benefits are in offering healthy food at reduced prices to underserved communities. In terms of wasted food, Daily Table is piloting a model for offering a new secondary market for food items that would potentially become wasted food. Still in its early stages of development but looking to expand, Daily Table uses food rescue to address food insecurity by offering healthy, prepared meals in a retail setting.

Key Insights: Daily Table is testing the viability of using food donated and purchased through secondary markets. These food items are transformed during careful preparation and cooking into appealing, healthy, prepared foods and grocery staples that are sold in a retail setting to underserved communities.

Sources: Luna 2015; Kazda 2016; Mott 2015.



Source: The Daily Table 2015.

2.2.2 Approach 2 – Storage and Transportation Improvements

Case Study 14. Canada: Grocery Meat and Food Terminal Rescue Programs / Moisson Montréal

Stage of Food Supply Chain: Secondary Market

Moisson Montréal is a food bank that specializes in rescuing perishable food products, such as meats, vegetables and fruits. Most of the food rescued (85%) needs to be kept cold or frozen; this contrasts with the situation at most food banks, which rely on rescuing mostly dry goods. Since most food banks cannot afford the investment in trucks that have freezer capabilities and in large cold/freezer storage units, Moisson Montréal has assumed the role of a central collection, storage, and distribution hub for perishable food products. Due to its large size, Moisson Montréal uses a software-based inventory tracking system, which allows the organization to track incoming and outgoing donations. Moisson Montréal redistributes the perishable food to food banks located throughout the Province of Quebec; however, it requires the food banks to come to the distribution center to collect the food. When organizations pick up the food, they go through a grocery check-out type of system linked to the software, so that Moisson Montréal can track exactly how much food is distributed.



Source: Moisson Montréal 2015b.

In 2015, Moisson Montréal worked with 293 agri-food suppliers (including food manufacturers, distributors and grocery stores) to collect perishable foods, which are distributed to over 250 community-based organizations on a regular basis. The food helps feed over 146,000 people each month.

Meat and fish are the food items most in demand from community organizations. To help accommodate this need, in 2013 Moisson Montréal implemented a pilot project with ten grocery stores (Loblaw's), to rescue meat that was near the best-before date and would have been thrown out. The success of the pilot resulted in the project's being expanded to stores located throughout the Montreal area. Today about 110 grocery stores participate in the meat rescue project.

Meat that is no longer wanted by the supermarket is placed into plastic containers and put in the freezer until it can be collected by the organization. Moisson Montréal has three freezer trucks dedicated to the grocery store and meat program and manages between 200 to 220 pick-ups per week from the participating stores, or about 40 pallets per day. At the same time, Moisson Montréal will pick up other food products (e.g., bakery, fruits, and vegetables) from the stores but most of the emphasis is on meat.

Moisson Montréal emphasizes quality control at every stop, with every plastic bin identified by number and tracked manually. Upon reaching the distribution center, the meat is repackaged and categorized and the information is entered into a computerized program for warehouse management. This approach was developed in response to brand-risk concerns identified by some donors.

The meat is stored in a freezer at Moisson Montréal until it is ready to be collected by the agencies, at which time the frozen meat is placed in polystyrene coolers to keep it frozen while being transported. All meat is tracked and the information is sent back to each store on a monthly basis.

The meat is re-distributed only to agencies involved in food transformation (e.g., community kitchens, meals providers, such as The Salvation Army, Meals-on-Wheels, etc.) that have staff that are trained for safe handling and cooking of meat. It is not donated for food baskets, due to health and safety

concerns. There are approximately 90 agencies in the program and the meat donations cover 100 percent of the meat needs of these agencies.

During the pilot, Moisson Montréal did not receive as much meat as anticipated and found out that many of the grocery store staff did not understand the nature of the project and who would be benefitting from the donations. In response, Moisson Montréal developed a training program for employees of grocery stores, to explain the program, who benefits and how to participate. A seven-minute animated video was developed, along with an interactive training program for the employees. The training resulted in a doubling of the meat donations.

In addition to grocery stores, Moisson Montréal started working with vendors at the Montreal Food Terminal located at Marché Central, to collect fruits and vegetables that were not sold at the end of the day. The Montreal Food Terminal generates an estimated 50 tonnes of wasted food per day. Moisson Montréal has a dedicated truck that collects 20–25 pallets of perishables every day, which is equivalent to 8–10 tonnes of food. Of the food rescued, about 85% is considered edible, with the remaining 15% being inedible. Drivers must evaluate the quality of the produce to ensure that the vendors are not trying to offload inedible food. If this happens, then Moisson Montréal will send a representative to talk with the donor and try to work out a solution. If the problem persists, then Moisson Montréal will remove the vendor from its donor list for a period of time. The Food Terminal supplies 70% of the fruits and vegetables collected by the organization.

Positive Impacts: About 60,000 to 65,000 kilograms of meat per month are rescued by participating grocery stores. The remaining food is donations from the Montreal Food Terminal (35%) and other suppliers (55%). With the success of the meat rescue project, Moisson Montréal has been working to expand the project to other grocery stores in the Montreal area. The organization is also working to help other organizations outside Quebec, e.g., Second Harvest, establish similar programs in their area. Moisson Montréal has a major project in the works for determining a way to rescue 100% of the unsold fruits and vegetables at the Montreal Food Terminal, thus ensuring the rescue of 50 tonnes of fresh produce now wasted every day.

Key Insights: The Quebec government has announced that within the next five years it will introduce a provincial law banning organic material from disposal throughout the province. Staff at Moisson Montréal see huge obstacles that will need to be addressed prior to the implementation of the law, including the need to de-package all food before it can be sent for processing into animal feed or for composting. The process to set up de-packaging will be very expensive, as the infrastructure to accommodate it will need to be developed. By-laws may need to be re-examined, to ensure that the pre-packaged food can be transported, stored and re-purposed.

Sources: Interview C32; Moisson Montréal 2015a; Moisson Montréal 2015b.

2.2.3 Approach 3 – Liability Protection for Donors

Case Study 15. Canada: Guidelines for Industry Food Donation / BC Centre for Disease Control

Stage of Food Supply Chain: Post-Harvest, Processing, Retail, Foodservice

The British Columbia Centre for Disease Controls (BCCDC) is an agency of the Provincial Health Services Authority and is responsible for investigating and evaluating the occurrence of communicable diseases in British Columbia. The organization provides provincial and national leadership in public health, through surveillance, detection, prevention and consultation and provides both diagnostic and treatment services directly to people with diseases of public health significance.

Acknowledging that many British Columbians depend on food bank assistance and on other charitable organizations for food, BCCDC developed two guidelines on food security and food donations.

The first document, *Guidelines for Food Distribution Organizations (FDOs) with Grocery or Meal Programs*, was developed to provide guidance on liability issues, and relationships with volunteers and other FDOs, as well as guidelines on nutritious and safe foods that are suitable for donations. The document also provided samples of Memorandum of Understanding (MOU) agreements, as well as flowcharts to evaluate frozen, cold and boxed foods.

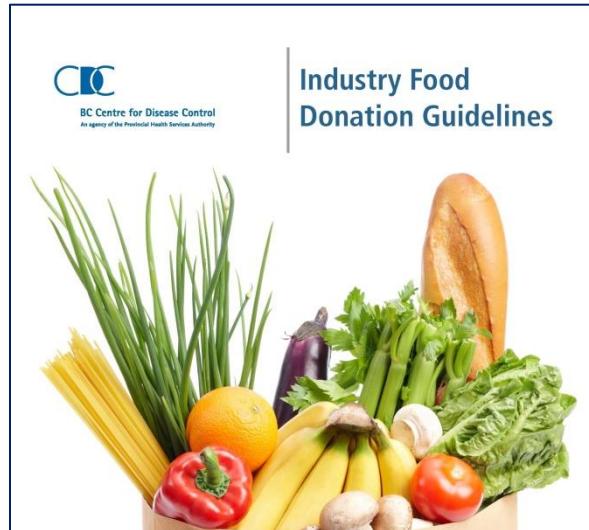
The second document, *Industry Food Donation Guidelines*, was developed specifically for business owners, managers and decision makers, to establish the rationale for donating food, guide them on how to start and manage a food donation program, explain which types of foods are suitable for donations, address concerns about liability issues, and assist the industry in connecting with FDOs.

Positive Impacts: Since the first publication of them in 2015, the guidelines have been updated to provide additional information on a range of diverse services offered by BCCDC's initiative. Another component of the updated guidelines is a focus on how FDOs can communicate effectively with industry, volunteers and other FDOs.

The guidelines have proven to be useful as a platform for partnership and collaborations. For example, charitable organizations such as the Greater Vancouver Food Bank and Food Banks BC, together with the Metro Vancouver Regional District, have worked in collaboration to develop both guidelines. The guidelines also demonstrate the importance of developing relationships between FDOs and donors as well as the significance of rescuing and redistributing safe and healthy foods.

Key Insights: It is clear that the need to update the guidelines was due to a growing interest in supporting healthy and safe food donations. Restaurants Canada, the national non-profit association representing the restaurant and foodservice industry, has also promoted the guidelines on its industry website, to facilitate food donations. The key for success is awareness on the part of potential donors that donation of healthy food is relatively easy to navigate and that there is growing support and resources from organizations such as BCCDC.

Source: BCCDC 2015.



Source: BCCDC 2015.

2.2.4 Approach 4 – Online Food Rescue Platforms

Case Study 16. United States: Smart Phone App / Food Cowboy

Stage of Food Supply Chain: Secondary Market

Food Cowboy is one of several recently developed smart phone apps attempting to fill a gap in the food rescue system in the United States. Founded to better connect the millions of entities that generate excess and unwanted food at grocers and restaurants with people who need it, the app connects the donors directly to the receiving charity.

Donors with excess food and charities that want the food to support their anti-hunger initiatives register using the app. When donors post available food, the charities receive an alert with the location, contact information, type and size of the donation. They are permitted to accept only what they want and can use. The app also includes a mutual rating system similar to those of other peer-to-peer apps that incorporate public ratings and comments.

The Internal Revenue Code allows food companies to deduct 50% of the fair market value minus the cost of food when they donate excess food instead of sending it to landfill. Food Cowboy charges a 15% commission on that “lost profit” for each donation made through the app. It uses the charge to fund its operation and build the service. Food Cowboy also plans to donate two thirds of revenue up to \$50 million a year to helping charities cover the costs of extending operating hours, obtaining donations, and increasing cold storage.

In July 2016, Food Cowboy began using some of the profit to support two initiatives that will fund startups, and technologies for reducing FLW. Food Cowboy established The No Waste Promise Alliance and the Food Waste Innovation Fund so as to invest up to \$75 million per year in public- and private-sector solutions for dealing with wasted food.

Positive Impacts: As of June 2016, Food Cowboy had over 400 charity users and 200 donors. Building on mobile technology, owners of Food Cowboy and other apps consider their companies as technology startups in a testing phase. As startups, they rely heavily on building scale to meet their goals and have a meaningful impact on the problem of wasted food.

Key Insights: The ubiquity and ease of use of mobile technology, coupled with the large potential tax benefits, have made direct connection of donors and recipients easier. If widely adopted, apps like Food Cowboy could dramatically expand the donation of excess food and provide a streamlined mechanism for both donors and charities looking for food donations.

Sources: Interview U32; Food Cowboy 2015; Strom 2016.



Source: Food Cowboy n.d.

2.2.5 Approach 5 – Feeding Animals

Case Study 17. Canada: Fish Feed from Insect Larvae Raised on Wasted Food / Enterra

Stage of Food Supply Chain: Secondary Market

Conventional fish feed is produced by harvesting small wild marine fish and mixing them with soy into pellet-shaped products. The production of soy for fish feed uses up scarce land and water resources. Born out of these



Source: Enterra Feed Corporation 2016.

concerns, Enterra has a mission “to secure the future of the world’s food supply by solving two global problems: wasted food and nutrient shortage.” Its business is to make dried larvae feed for fish meal and poultry meal, as well as organic fertilizers to be used on local farms. Enterra upcycles nutrients from pre-consumer wasted food collected from generators such as farms, supermarkets, greenhouses and bakeries, and feeds it to larvae of the black soldier fly. The larvae are then harvested and turned into feed products. The larvae themselves are also edible by humans, making them a potentially effective source of protein, should consumers be more open to consuming insects, but in Canada they are not currently approved for human consumption. The company is currently producing more than 110 million soldier fly larvae per day.

Positive Impacts: The upcycling and recovery of pre-consumer wasted food is a key component of this business and allows it to solve numerous problems, including overfishing, land degradation and water scarcity. Enterra plays an important role in food recovery by closing the food system loop and tying waste management back to food production. Another positive side effect of feeding wasted food to larvae is that this process also produces a manure-type product, which can be used as a natural fertilizer. In terms of organic processing methods, Enterra’s is high value in comparison to windrow composting or anaerobic digestion and is climate-change friendly, producing no methane and minimal carbon dioxide.

Key Insights: Enterra has been able to close the loop on wasted food through a process of upcycling the nutrients from wasted food back into the food chain. It provides a sustainable protein source for fish and poultry and a great source of fertilizer for agriculture. The company is expanding internationally and sales are growing, especially in the United States. Enterra has become the first manufacturer of an insect protein product to have completed the registration process for it as a feed ingredient in Canada. This product is currently approved for use in poultry feeds, and the company submission for use in fish feed is pending.

Sources: Enterra Feed Corporation 2016; Tamminga 2015; Cook 2014.

Case Study 18. Mexico: Producing Fish Meal from Fish Waste / La Nueva Viga Fish Market

Stage of Food Supply Chain: Secondary Market

La Nueva Viga is the largest fish and seafood market in Mexico and Latin America, and the second-largest such market worldwide. *La Nueva Viga* distributes 1,500 tonnes of fish and seafood per day (fresh and frozen), which constitutes 70 to 80 percent of Mexico's total production. The market center distributes products primarily to small markets, restaurants, other cities around the country and to direct retail.

La Nueva Viga has 422 producers and distributors: 202 wholesale stores, 55 retail stores and 165 medium-sized wholesale stores, called *tianguis* (of which 132 are restaurants), occupying a space of approximately nine hectares beside the Central Supply Market (*Central de Abastos*) in Mexico City.

La Nueva Viga receives fish and seafood mainly from domestic production, but also receives products from imports. Most of the fish comes from the Mexican coast, about 12 hours away from Mexico City. Approximately 30 to 40 percent of the fish is sent frozen from its place of origin, and the remaining fish comes fresh to the marketing center via cold transport.

The products are sold fresh within two days, on average. *La Nueva Viga* has two strategies for managing the surplus fish that is not sold. A small amount of the fresh product received is frozen, then sold onsite. The remaining unsold fish still in good condition is combined with fish scraps and saved for processing. Marketed as fish waste, it is sold to fish meal-producing companies.

Positive Impacts: Before 2013, *La Nueva Viga* paid waste haulers to pick up fish waste for disposal. The quantity of waste represented approximately 2 percent (11,000 tonnes) of the total product volume entering the market annually, and the cost of collection was approximately P\$160,000 per month. Since 2013, instead of paying for collection, *La Nueva Viga* receives around P\$215,000 per month to sell fish waste for processing. Due to the success of this project, *La Nueva Viga* has plans to enlarge and formalize the wasted food recovery system, assess other food recovery internal mechanisms and investigate other byproduct distribution. Instead of being sent to landfill, fish waste is recovered as a food product, with corresponding positive environmental impacts.

Key Insights: A good practice for managing fish oversupply is to freeze and then sell products. When freezing is not viable, a secondary option is to use the fish for processing into a more stable product, such as fish meal, which also results in creating a secondary market for this product stream.

Sources: Compesca 2013; Interview M56.



Source: Bergua 2016.

Case Study 19. Mexico: An Example of Food Recovery for Animal Feeding / Medellín Market

Stage of Food Supply Chain: Secondary Market

Market Melchor Ocampo, commonly known as *Mercado Medellín* (Medellín Market), is located in the heart of Mexico City. With over 504 stalls, this market offers a wide variety of perishable food products. These include fruits and vegetables, meat, poultry, fish and grains. Approximately 20 percent of the products in this market are imported from Colombia, Peru, Argentina, Cuba, Venezuela and other Latin American countries. The diverse range of immigrants represented at the market may explain why immigrant support-related nonprofits are actively involved in food recovery at this site.



Source: Bergua 2016.

Fruits, vegetables and fish carcasses are thrown into the disposal area, which is cleared every two days by the “pepenadores,” or waste pickers who reroute viable food for recovery. An estimated five to 10 kilograms of food waste is generated from each vendor. This is representative of 5 to 10 percent of what the owners buy for their individual stall. Surplus food is donated to existing nonprofit organizations that help immigrants who are in need of food. Some vendors donate excess groceries and cold meats to market visitors.

Chicken byproducts from Medellín Market and a nearby Colonia Juárez market are sent to a pig farm in Texcoco, Mexico City, for animal feed. Fish carcasses are also used as animal feed. Fish leftovers are used as inputs at other food processing industries.

Positive Impacts: An estimated 30 tonnes of chicken and fish byproducts are diverted to animal feed, and there is potential to divert more.

Key insights: Other Mexican markets are likely generating considerable food waste amounts that are currently disposed of in landfills instead of being recovered for alternate uses. These practices could be better managed by introducing food recovery initiatives and regulations—in coordination with key stakeholders, such as animal feed processing companies. The coordination between different stakeholders can help ensure safe handling and management of cold-chain, equipment and space usage for diverting surplus food to animal feed.

Sources: Interviews M71 and M72.

2.3 Measuring, Tracking and Reporting Food Loss and Waste

Measuring, tracking and reporting provide tools to more effectively inform actions to meet food loss and waste (FLW) reduction and food rescue and recovery goals. Measuring is the quantification of FLW and involves determining the amount of FLW by using an instrument or device marked in standard units or by comparing it with an object of a known amount (WRI 2016). Tracking is recording continuous and consistent detailed information while comparing results against a baseline or targets (WRI 2016). Tracking enables establishment of baselines, visualizations of trends, diagnosis of issues to identify reasons why food is wasted and increased awareness about the amount of FLW (LeanPath n.d.). Reporting shares results from measurement and tracking, increases accountability, and supports engagement with internal and external stakeholders including those responsible for setting the FLW reduction goals (WRI 2016). Four varying approaches are applicable to the case studies in this section:

- **Waste Composition Analysis** to physically sort FLW from other material to determine weight and composition.
- **Dairies** to maintain a daily record or log of FLW and other information.
- **Surveys** to gather data on FLW quantities and other relevant information from a large number of individuals or entities through a set of structured questions.
- **Models and Proxy Data Extrapolation** to utilize data to infer quantities using a mathematical approach based on the interaction of multiple factors that influence the generation of FLW.

2.3.1 Approach 1 – Waste Composition Analyses

Case Study 20. Canada: Food Waste Characterization Study / Metro Vancouver Regional District

Stage of Food Supply Chain: Processing, Retail, Foodservice

The Metro Vancouver Regional District regularly commissions waste characterization studies in order to acquire data on food loss and waste (FLW) quantities disposed of as garbage, from all sectors, and as organics for composting, from the single-family residential sector. Waste characterization studies are also used to track progress toward diversion goals: 70 percent of all waste by 2015 and 80 percent by 2020. The most recent studies were timely, as Metro Vancouver passed the Organics Disposal Ban in 2015. The ban requires residents and businesses to separate foods scraps and clean wood from their garbage.

The Metro Vancouver 2014 Waste Composition Study focused on the institutional, commercial and light-industrial (ICI) sector. Four major ICI industry groups were studied because they generated the most solid waste and presented opportunities for waste reduction: accommodation and foodservices, business commercial services, manufacturing, and retail trade. A total of 98 garbage samples were hand-sorted into 130 material subcategories. Most (90 percent) of samples were collected directly from the participating business, allowing more detailed and accurate sorting. The



Source: Metro Vancouver 2015.

2014 study introduced a new waste characterization subcategory—“donatable food waste”—separate from the previously used subcategory of “compostable food waste.” Donatable food refers to items such as packaged foods, produce, grains and canned goods from grocery stores that have passed their “sell by” date but not their expiration date; ready-made, edible food items from convenience stores and cafés; and a portion of FLW from restaurants that is a result of over-purchasing.

The Metro Vancouver 2015 Solid Waste Composition Report studied a broader range of sectors: ICI, single-family residential, multi-family residential and drop-off or self-haul customers. A total of 107 garbage samples were hand-sorted into 138 material subcategories. The 2015 study introduced specific subcategories for the identification of food waste as “avoidable” or “unavoidable.” In this study, avoidable food waste refers to foods that could have been eaten, such as leftovers or plate scrapings. Unavoidable food waste refers to food (or drink) waste that is not edible under normal situations, such as bones, egg shells and tea bags. Avoidable food waste includes subcategories for whole fruits and vegetables, whole meats and fish, full/unused ready-made packaged items, baked goods, deli items, and liquids (packaged drinks and oils).

Positive Impacts: When the ICI sector participated in its 2014 study, Metro Vancouver found that many property managers and businesses were interested in joining because they wanted better information on the performance of their existing organics programs, or wanted opportunities to implement new programs, especially in anticipation of compliance with the Organics Disposal Ban. The data were also useful for evaluating the effect of ICI FLW reduction and diversion programs on quantities and types of materials disposed of at Metro Vancouver’s solid-waste facilities and to track progress toward diversion goals. The detailed FLW categories help focus Metro Vancouver’s efforts on the sectors that create the most waste and on the potential reasons for that waste. Detailed categories, by type of food, such as meats versus vegetables, allow Metro Vancouver to estimate greenhouse gas (GHG) emissions from FLW more precisely.

Key Insights: The ICI waste composition analyses did not just serve as a measurement tool, but also as an outreach tool to help businesses improve waste diversion. For the residential sector, by studying materials separated for organics collections as well as garbage, Metro Vancouver obtained a more complete estimate of FLW. As more jurisdictions include FLW in curbside composting programs, conducting composition studies for organics becomes important, in order to avoid underestimating quantities of FLW.

Sources: Metro Vancouver 2015b; Metro Vancouver 2016.

Case Study 21. United States: Food Waste Data Used to Support State of Massachusetts Commercial Organics Waste Ban / Massachusetts Department of Environmental Protection (MassDEP)

Stage of Food Supply Chain: Processing, Retail, Foodservice

In October 2014, the Massachusetts Department of Environmental Protection (MassDEP) established the Commercial Organics Waste Ban, which requires all businesses and institutions disposing of over one US short ton (0.9 tonnes) of commercial organic material per week to divert that organic material from disposal as trash. MassDEP found that 25% of its discarded waste is composed of FLW and other organics.

Massachusetts set a goal to divert at least 35% of FLW from disposal by 2020, increasing diversion by more than 385,000 tonnes per year. Targeted business and institutional sectors include hotels, supermarkets, convention centers, large institutions, FLW processors and institutional foodservice providers.

To plan for and manage their Commercial Organics Waste Ban, the MassDEP and stakeholders needed better information on organics generation and disposal. MassDEP detailed measurement and data analysis activities in its Organics Study and Action Plan (most recently updated in 2016). These measurement efforts include:

- **Food loss and waste density mapping** – Identifies major sources of FLW and can assist haulers and processing facilities with routing and facility locations.
- **Waste characterization** – Analyzes organic portions of waste stream from Massachusetts waste composition study conducted every three years.
- **Food loss and waste generation data** – Quantifies current FLW diversion by State facilities with the Lead by Example Program and gathers information on how to increase diversion at institutions such as universities, correctional centers and hospitals; also surveys large food manufacturers, processors and other large generators on their organics generation.
- **Monitoring of statewide efforts** – Establishing a baseline and developing a program measurement protocol to monitor statewide efforts; example metrics include permitted composting capacity and tonnes diverted.

Positive Impacts: The information MassDEP collects helped generators, collectors and processors of organics make sound infrastructure investments. This information also helped inform where to target direct government assistance FLW prevention, rescue and recovery programs. MassDEP periodically updates its action plan and continues to collect data to monitor statewide efforts, which helps track progress on organics diversion and provides data on the effectiveness of Massachusetts's strategies to divert FLW.

Key Insights: To help businesses determine if they dispose of one US short ton of organic waste a week, the MassDEP-funded program RecyclingWorks Massachusetts provides free technical assistance, informational workshops and online tools and guides for businesses to estimate their FLW amount. The MassDEP Organics Subcommittee is part of the Solid Waste Advisory Committee, which contributed to developing the Massachusetts 2016 Organics Study and Action Plan.

Source: Massachusetts Department of Environmental Protection n.d.



Source: Biocycle 2013.

2.3.2 Approach 2 – Diaries

Case Study 22. Mexico: People-centered Approach toward Food Waste Management in the Urban Environment of Mexico / PhD dissertation

Stage of Food Supply Chain: Consumer

As part of a PhD dissertation, a method was developed and implemented to measure food loss and waste (FLW) from residential dwellings in Mexico City and Jiutepec (Morelos). Data collection tools generated qualitative and quantitative information from households, to capture behaviors concerning FLW, types of wasted food and amount of food disposed of. The data collection process included a household-based survey and an FLW diary in which participants recorded and weighed food that they disposed of in their homes.



Participants were recruited from areas of varying affluence, to ensure a diverse representation of households in Mexico City and Jiutepec. In total, 120 households participated in this study.

Detailed demographic information was collected from the households so as to explore various socio-economic factors that may affect FLW. These factors included type of dwelling, access to water and sanitation, street cleaning frequency, education, average size of residence, type(s) of meals most frequently shared at home, location of home and average household size.

The household survey also included questions about FLW separation habits, such as separation of FLW from other household garbage, usage of a compost system and collection frequency of waste. It also inquired about community involvement, such as perception of community participation, and personal degree of attachment to the neighborhood.

The FLW diary was recorded by a member of each participating household for a seven-day period. For each meal consumed at home, each type of FLW was recorded and weighed. The location of disposal (e.g., compost, kitchen drain, general kitchen bin) and the type of FLW (e.g., vegetable/fruit peelings, raw food/meat scraps, beverage, spoiled food, cooked food/excess food) were also recorded. The most common types of FLW encountered were fruit and vegetable peelings.

The data collected estimated that FLW disposal was 0.2 kilograms per capita per day in less affluent areas and 0.14 kilograms per capita per day in more affluent areas.

Positive impacts: This study provided valuable information to local government agencies, NGOs, and other food system stakeholders working to understand and address FLW issues. The detailed socio-economic analysis highlighted correlations between FLW and social factors as well as behaviors that shape FLW in different neighborhoods.

Key insights: Combining socio-economic surveys in conjunction with FLW studies can provide actionable information connecting FLW behaviors and demographics information. The community-centered approach enables stakeholders to create tailored strategies that effectively target needs and behaviors of different socio-economic groups.

Source: Jean-Baptiste 2013.

Case Study 23. United States: Cutting Down Food Loss and Waste and Food Cost / Gold Strike Resort and Casino, MGM

Food Supply Chain Stage: Foodservice

Gold Strike Resort and Casino, in Robinsville, Mississippi, serves more than 650,000 guests each year. It contains a range of different dining options for guests, including a steakhouse, quick bites, lounges and buffet. The Gold Strike team was concerned about FLW from the all-you-can-eat buffet. Rising food prices spurred action, as it was clear that the current methodology of using prep sheets, par lists and production guides was not sufficient. In 2014 the team began tracking waste with the LeanPath 360 program, installing

LeanPath Trackers in two kitchens so as to specifically track and help reduce FLW.

When the management team unveiled the program to its staff, it was met with a mixed reaction—some staff were excited, and some were suspicious that this was a program to track individual performance. To encourage staff to use the program, the management team implemented rewards for staff engagement, recognizing the person with the most transactions each week as the “top tracker” and rewarding him/her with a free meal at the buffet. At the pre-shift meeting, the team talked about who was in the lead, creating friendly competition among the group, which led to full participation and accurate data collection.

One of the biggest findings for the team after the tracking process was well underway was that breakfast items made up a significant portion of FLW. They discovered the teams were continuously producing full batches of product until the change-over time of 11:00 am. At the end of the breakfast period, they were throwing away pans of pork product, eggs, and pancakes, all due to overproduction. Once the staff started seeing the FLW numbers tied to the overproduction, they started cutting back production. Certain items were shifted to à la carte cooking, including pancakes, French toast, and other items that could not be saved and repurposed at the end of the shift. This transition provided a fresher product for the customers and significantly less waste at the end of the meal period.

Positive Impacts: After using the LeanPath 360 program for 12 months, the Gold Strike Buffet had reduced pre-consumer FLW by more than 80 percent and food costs had dropped by 5 to 6 percent on average each month. In addition, it has increased staff engagement and awareness concerning FLW.

Key Insights: It is not always apparent what is being wasted until it is measured. By setting up FLW measurement systems, kitchens can identify where and how much FLW is occurring and then use that information to create viable solutions.

Source: LeanPath n.d.



Source: Gold Strike Casino Resort n.d.

2.3.3 Approach 3 – Surveys

Case Study 24. United States: Food Waste Study / Food Waste Reduction Alliance

Stage of Food Supply Chain: Processing, Foodservice, Retail

In 2011 the Food Waste Reduction Alliance (FWRA) set out a three-year plan with non-profit think tank BSR, to assess the current US food industry landscape in order to better understand the scale of food loss and waste (FLW) and the challenges that contribute to FLW. The plan included gathering quantity data on edible food donations, food re-use and recycling and other FLW disposal, directly from participating companies in the manufacturing, retail and foodservice sectors. Research also addressed challenges to increasing donation, re-use and recycling. The three studies conducted by FWRA and BSR used progressively more-extensive data to develop statistics and national estimates of FLW from the sectors covered:

2012 BSR Food Waste Assessment—the initial study to estimate FLW, based on publicly available data.

2013 Analysis of US Food Waste among Food Manufacturers, Retailers and Wholesalers—the second study, based on primary data collected from food companies through surveys with responses from:

- 13 manufacturers, representing approximately 17 percent of the projected sales from the US manufacturing sector; and
- 13 retailers/wholesalers, representing approximately 30 percent of projected sales from the US grocery retail/wholesale industry.

2014 Analysis of US Food Waste among Food Manufacturers, Retailers and Restaurants—the third and final study, also based on primary data collected from food companies through surveys with responses from:

- 16 manufacturers, representing approximately 17 percent of projected sales in the US manufacturing sector;
- 13 retailers/wholesalers, representing approximately 32 percent of projected sales in the US grocery retail/wholesale sector; and
- 27 restaurants (14 companies with no more than 10 locations each), representing approximately 32 percent of projected sales in the US restaurant industry.

Positive Impacts: This first-ever US food industry assessment allowed FWRA members to analyze the current state of the industry’s FLW management practices and to provide benchmark data to measure progress in reducing FLW. FWRA’s study demonstrates cross-industry collaboration as an option for gathering FLW data.

Key Insights: The data collected in FWRA’s reports allow companies to compare their performance against that of their peers, both in adoption of best practices and in generation of FLW. FWRA’s reports and information about decreasing FLW challenges can inform the food industry and policymakers about where further collaboration and solutions are needed.

Sources: BSR 2012; BSR 2014; BSR 2013.



Source: Food Waste Reduction Alliance

2.3.4 Approach 4 – Models and Proxy Data Extrapolation

Case Study 25. Canada: The Importance of Quantifying Food Waste in Canada / Journal of Agriculture, Food Systems and Community Development

Stage of Food Supply Chain: Retail

The authors of the 2013 academic paper *The Importance of Quantifying Food Waste in Canada* highlighted the importance of quantifying the amount of food loss and waste (FLW) along the food supply chain in Canada. They estimated the amount of FLW in Canada from 1961 to 2001 for different food category types, at the consumer and retail levels. To provide the estimations, they proposed a quantification methodology for FLW that applies secondary data from Statistics Canada on food availability, food loss, and spending on food, to supplement the lack of detailed FLW data in Canada.



Statistics Canada compiles data from “a wide variety of sources, both survey and administrative, and from various divisions within Statistics Canada along with other government departments” on food availability for the following major categories: fruits, vegetables, animal products (including red meat, poultry, eggs, milk and cheese), cereals, sugar and syrup, oils, fats and beverages. Statistics Canada estimates food loss using adjustment factors developed by the US Department of Agriculture Economic Research Service.

The authors also used data from Statistics Canada on personal income and consumption spending to examine spending on food in total, and spending on food purchased from stores versus from restaurants, separately. Analysis identified that increases in spending on food from restaurants has outpaced increases in spending on food from stores; however, the authors concluded that more research is needed to assess whether or how this shift in spending has affected increases in FLW.

This study found that:

- FLW is estimated to have increased by 40 percent from 1961 to 2009;
- the increase in FLW was larger than the increase in available food for consumption over that time; and
- the highest percentage of FLW was found in vegetables and fruits while the lowest percentage was in pulses and nuts.

A conclusion of the authors was that increases in the consumption of fresh vegetables and fruits—both perishable products—may be contributing to the increase in FLW.

Positive Impacts: This quantification study helps provide much-needed data (such as that FLW in Canada increased over time between 1961 and 2009) about Canada’s FLW amounts on a national level. It also suggested that available food for consumption per person, per-capita GDP, and per-capita income may be factors that increase FLW. By using historic data, this methodology allows researchers to assess trends in FLW from the past to the present, unlike methodologies that require new data collection. The authors hypothesize that FLW quantification data will increase awareness about FLW and food purchasing and eating habits. This awareness may then promote FLW reduction and improve food security; food quality; and sustainability in the economy, community and environment.

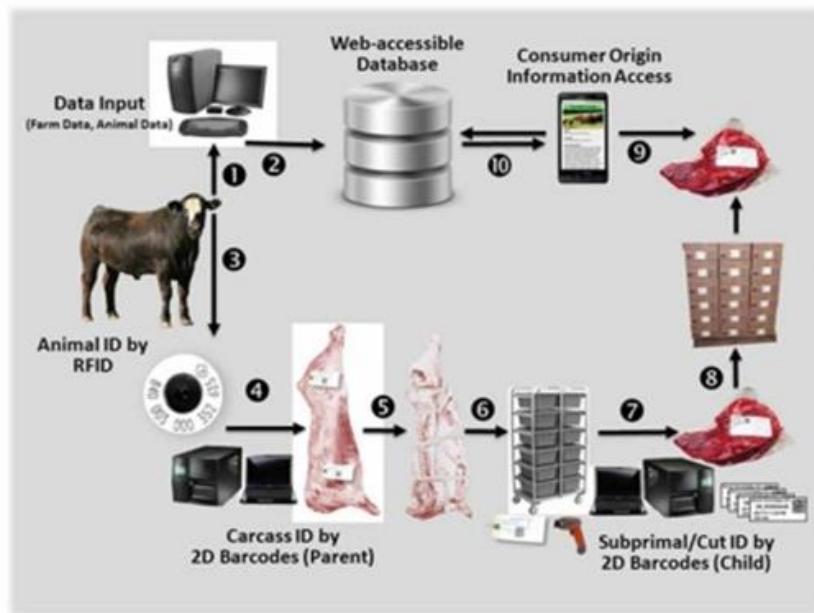
Key Insights: Applying Statistics Canada data was helpful in its methodology, but has limitations—such as having to use food loss data from the US instead of Canada. The authors recommend conducting a replicable pilot study to collect primary data for quantifying FLW along the food supply chain in Canada. This methodology can be used to compare FLW over time to other factors such as Canada's population or different food categories, so as to help assess trends and determine where to focus FLW intervention efforts.

Source: Abdulla et al. 2013.

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Food Systems: Transdisciplinary Research and Practice



A New Model for Tracing the Origin of Beef Within a Local Institutional Value Chain



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Source: Journal of Agriculture, Food Systems and Community Development
2013.

Case Study 26. Canada: “\$27 Billion” Revisited: The Cost of Canada’s Annual Food Waste | Value Chain Management International

Stage of Food Supply Chain: Post-Harvest, Processing, Distribution, Retail, Foodservice

In 2014, the consulting firm, Value Chain Management International (VCMI), revisited its FLW estimations from its 2010 *Food Waste in Canada* report. Its updated estimate that C\$31 billion worth of food is wasted annual in Canada is a 15% increase from its C\$27 billion estimation in 2010. This 15% increase was due to newly available FLW data and insights about seafood (including catch and processing) and parts of international catering waste that were not included in the previous study. VCMI’s estimations were produced by analyzing existing data, particularly from Statistics Canada, information gathered from communications with the commercial food industry, and other assumptions. VCMI applied the methodology summarized in the table below, to estimate the economic value of FLW along the value chain (on-farm, processing, transport and distribution, restaurant and hotels, retail, consumers, international catering waste) in Canada.



Source: Gooch et al. 2014.

Value Methods Used in Value Chain Segments

Value Chain Segment	Value Method
Farm; Processing; Transport and distribution	Applied industry stakeholder estimates of average percentage waste at the field, during processing and packaging and during transportation and distribution, to the dollar value of agricultural and seafood products sold in Canada in 2012.
Restaurants and hotels	Applied industry stakeholder estimates of the percentage of FLW in a “well-run restaurant” plus an additional assumption regarding the percentage plate waste, to the dollar value of food purchased from restaurants in Canada in 2011.
Retail	Applied industry statistics provided confidentially; no further details on the estimation method were provided.
Consumers	Applied Statistics Canada’s 2007 estimates of solid and liquid FLW, in kilograms per person, to the current population. Applied assumptions on prices per kilogram (separately for solid and liquid foods) to estimate the dollar value of wasted food.
International catering	Developed assumptions regarding the average number of in-flight meals per passenger per flight, the percentage of FLW, and the dollar value of each meal. Applied assumptions to the number of international passengers traveling to or from Canada in 2012.

Positive Impacts: By presenting the dollar costs of FLW, rather than tonnages, this study builds the financial case for businesses to evaluate and redesign their operations to prevent avoidable food loss and associated waste. This report is also the only report in Canada currently that breaks down the sources of FLW by stage of the food supply chain.

Key Insights: While the quantifiable value of FLW was estimated in this report, the true value is more likely to be higher, due to the omission of other food-chain sectors which were not included in the study because of limited available data. FLW imposes substantial costs on businesses and consumers in Canada, but these costs are often hidden or not apparent. This quantification methodology can be expanded by obtaining data for additional institutional sectors.

Source: Gooch et al. 2014.

Case Study 27. Mexico: Food Losses and Food Waste / World Bank

Stage of Food Supply Chain: Post-Harvest, Processing, Distribution, Retail, Foodservice

The World Bank conducted a study that examined the quantity of FLW in Mexico and its associated environmental impacts.

The methodology selected to calculate the national FLW was informed by international studies, including FAO's. The study used data extracted from the National Survey of Income and Expenditure in Households (ENIGH), the restaurant industry, the defense industry (military), Agriculture Atlas, and the Agri-Food and Fishery Information Service (*Servicio de Información Agroalimentaria y Pesquera—SIAP*).



Production tonnage estimates for 79 food products were reviewed and extrapolated, in order to estimate the national FLW tonnage. The food items were selected from the ENIGH to represent a typical Mexican diet. For each of these products, the wasted food was calculated by adding together domestic production and imports, then subtracting exports and consumption. The remainder is considered waste. Note that this type of calculation does not include inedible parts of food, which are still a part of FLW. Furthermore, it does not differentiate between wasted food that is disposed of, versus composted or fed to animals. The total FLW was estimated to be 20.4 million tonnes per year, using this method.

The ecological footprint and water footprint associated with a select portion of the 79 product groups were calculated: The ecological footprint of 29 product groups was equivalent to 37 million tonnes of carbon dioxide, and the wasted water of 24 product groups was equivalent to 40 trillion liters.

Positive Impacts: This study identified some of the causes, quantities and environmental impacts of FLW, on a country-specific level, which had not been done before for Mexico. This information will be used to develop intervention strategies for an integrated approach to manage FLW and maximize food rescue and recovery.

Key Insights: Developing a product-based approach to estimate the quantity of FLW and its associated environmental impacts gives an additional level of detail that is specific to the food type. This is helpful in determining what types of food are wasted more, and solutions that target products versus FLW in general.

Source: Aguilar Gutiérrez 2016.

Case Study 28. United States: Loss-Adjusted Food Availability Data Series / USDA

Stage of Food Supply Chain: Retail

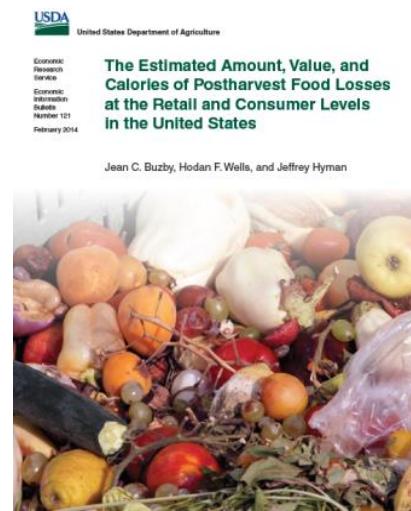
The United States Department of Agriculture (USDA) Economic Research Service (ERS) maintains the Loss-Adjusted Food Availability (LAFA) Data Series for over 200 agriculture product types. Food loss includes all post-harvest losses, such as food spoilage, non-edible food parts, plate waste, and cooking and moisture loss. The LAFA data are used primarily to adjust estimates of food availability and to monitor food intake and diet quality by estimating the per-capita number of calories and food patterns in the five major food groups and the amounts of added sugars, sweeteners, fats and oils. However, the loss assumptions in the LAFA Data Series have also been used by ERS to estimate the amount and value of food loss at the US retail and consumer levels. The amount of food loss is estimated by multiplying the quantity of that food product available for consumption by the appropriate loss assumption.

In 1992, ERS initially developed the food loss coefficients by using published reports and input from product experts; many reports dated from the mid-1970s or earlier and did not cover retail- and consumer-level losses. In 2005, ERS began a systematic study to update the coefficients with more-recent data. ERS worked with agricultural and academic institutions to update primary (e.g., farm) conversion factors. Working with consultants, ERS updated retail losses by comparing shipping and point-of-sales data in national supermarket chains. Losses at the consumer levels were estimated by comparing food purchase data from Nielsen Homescan (a market research dataset) with food consumption data from the National Health and Nutrition Examination Survey.

Positive Impacts: The LAFA Data Series is an important resource for the USDA ERS in estimating the amount of food loss and food available for consumption over time. These estimates from the USDA can help US governments and food industries get a better perspective on the food loss amounts and food group types and better inform their planning for FLW prevention and reduction initiatives. Researchers in other countries, such as Canada, use USDA coefficients—as used to develop USDA models—as the best available estimate of food loss.

Key Findings: The USDA's 2014 report, *The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States*, estimated for the first time the amount of calories associated with US food loss from the retail and consumer levels: 141 trillion calories per year, or 1,249 calories per capita per day, in the food supply in 2010. The top three food groups, in terms of share of total value of food loss, were meat, poultry and fish (30%); vegetables (19%); and dairy products (17%).

Source: Buzby et al. 2014.



Source: Buzby et al. 2014.

2.4 Policy and Education/Awareness Programs

Opportunities for policies and education/awareness programs to support and expand food rescue and recovery are plentiful. A selection of regional and national programs from North America and around the world is presented in this section.

Case Study 29. Canada: Food Waste Reduction and Practices Toolkit / Provision Coalition

Stage of Food Supply Chain: Processing, Distribution, Retail

Provision Coalition, a Canadian food and beverage manufacturers association, developed a free online sustainability portal as a one-stop sustainability resource for food and beverage manufacturers. The portal provides information, case studies and tools to help manufacturers assess, monitor and improve their social, environmental and economic performance and goals.

The Provision Coalition Food Waste Working Group launched a Food Waste Reduction and Practices Toolkit to help food companies quantify their avoidable food waste, calculate the value of their waste (disposal costs) and implement best practices to reduce avoidable food/beverage waste at the source, thus reducing the resulting greenhouse gas (GHG) emissions from its disposal. The toolkit has the potential to be adapted for other sectors across the value chain. Food companies can access the toolkit through Provision Coalition's online portal, to track and update their progress as often as needed. The toolkit consists of five sequential guidance stages:

- Quantifying food loss and waste (FLW)
- Identifying root causes of FLW
- Selection and evaluation of possible solutions
- Implementation of solutions
- Monitoring of solutions

Positive Impacts: The Food Waste Reduction and Practices Toolkit is designed to help manufacturers better measure and manage their FLW. Provision Coalition also hopes to gather the aggregated data once manufacturers begin to use the toolkit. By going beyond measurement to helping food and beverage manufacturers identify causes of FLW, select solutions and monitor results, this measurement tool could provide valuable information on the effectiveness of various FLW reduction strategies.

Key Insights: Provision Coalition is leveraging its relationships and collaboration within the food industry and other stakeholders to bring education on, awareness of and tools for reducing and prevent FLW.

Source: Provision Coalition 2017.



Source: Provision Coalition 2017.

Case Study 30. Mexico: Pilot Programs for Operational Changes / Simapro

Stage of Food Supply Chain: Processing, Foodservice

The International Labour Organization (ILO) developed the Integral System of Measurement and Productivity Improvement (*Sistema Integral de Medición y Avance de la Productividad*—Simapro), a methodology used to promote jobs and sustainability.

This was achieved through dialogue

among managers, worker's representatives, middle managers and operations staff about improving productivity, work conditions and equity within the organizations. Development also focused on workplace training to build the capacity of staff to identify opportunities to improve processes and ensure ongoing communication between operational staff and management. Food loss and waste (FLW) was one of the topics reviewed in the methodology and identified as one of the most profitable opportunities (through savings from reduced inputs) for optimizing efficiency.



Source: Flores 2016.

Positive impacts: In a pilot conducted in Bahia de Banderas (Riviera Nayarit) the methodology was implemented in five restaurants and one hotel. The methodology resulted in an average 32-percent reduction of FLW (532 kilograms in total among the pilot participants). The pilot participants saved a total of US\$36,000 as a result of the FLW reduced. Key intervention points were identified in food procurement, storage, and preparation of dishes to better suit customer needs. Changes that were implemented as a result of the pilot included:

- better organization of fridges to control food supplies;
- standardization of menu options, recipes and portion sizes;
- improved presentation of plates to customers;
- offering customers choices for their side dishes;
- overall cost control through tracking supplies; and
- increased awareness among staff about optimizing resources.

In the state of Chihuahua, the program was implemented in small and medium-sized enterprises in the dairy industry, as well as in several restaurants. Some improvements that reduced FLW in a dairy company were:

- improved sanitation in milk production, to ensure the product is uncontaminated;
- regulation of thermostats in incubation rooms that previously had variable temperatures;
- modification of the production process of Manchego cheese to reduce losses from 12 kilograms per batch to four kilograms per batch; and
- modification of production process of Chihuahua Cheese, resulting in a 2.5-percent efficiency increase.

Key Insights: Technical assistance to identify and implement improvements in the food processing and foodservice sector helps reduce FLW and improves productivity.

Source: Interview M12.

Case Study 31. United States: EPA Excess Food Opportunities Map US EPA

Stage of Food Supply Chain: Post-Harvest, Processing, Distribution, Retail, Foodservice

The US EPA plans to publicly release its new *EPA Excess Food Opportunities Map*, along with a report estimating excess food generation rates from industrial, commercial and institutional sources. The US EPA grouped industry classes into the following sectors: food manufacturers and processors, food wholesalers and distributors, educational institutions, the hospitality industry, correctional facilities, the healthcare industry, and the foodservices sector.

The map and report will identify generators of FLW and FLW recipients across the country. It will include a database of approximately 500,000 potential excess food “generators” in the US, with the business or institution’s name, geographical location, and an estimate of its excess food generation, as well as a database of approximately 4,000 potential recipients for excess food and scraps. The recipients include food banks, anaerobic digesters, and composting facilities. The report will also describe data sources and methodologies the US EPA used to estimate the excess food generation rate from US industrial, commercial and institutional sources.



Positive Impacts: The US EPA hopes local governments and project developers use the tool to gauge potential sources of FLW in specific geographic areas so that they can more effectively focus their efforts in FLW prevention, edible food donation and FLW recovery. It is another tool for stakeholders to use to communicate FLW information with one another and map out opportunities for collaboration. The tool may also influence how infrastructure is developed, depending on feedstock availability.

Key Insights: EPA’s FLW model was based on and inspired by the success of its interactive Waste to Biogas Mapping Tool, which promoted partnership among stakeholders in methane-rich biogas production. The states of Massachusetts, Connecticut, South Carolina and Vermont have used similar methodologies to derive estimations of FLW generation rate.

Sources: Interviews U22 and U6.

Case Study 32. United States: National Food Loss and Waste Reduction Goal / USDA and EPA

Stage of Food Supply Chain: Post-Harvest, Processing, Distribution, Retail, Foodservice

The US EPA and the USDA, led by Agriculture Secretary Tom Vilsack and the US EPA's Deputy Administrator, Stan Meiburg, announced on 16 September 2015 the first national goal to reduce FLW by half by the year 2030. This first-ever goal to reduce domestic FLW is aligned with target 12.3 of the United Nations Sustainable Development Goals. In pursuit of this goal, both the US EPA and USDA are seeking to

partner with communities, businesses,

charitable organizations and faith

communities, as well as partners at every level of government (state, tribal, local).



Source: USDA 2015.

There are three key objectives to this reduction goal: the first is to reduce waste to help feed the hungry, the second is to create an economic incentive for families and businesses to save money, and the third is to protect the environment.

An important component of the FLW reduction goal is measurement and tracking. Using available data from 2010, which pegged the FLW at 99 kilograms per person from residential, commercial and institutional sectors, the goal aims to halve the amount of FLW to 49.6 kilograms per person. As for food loss, in 2010, food loss totaled 60.3 billion kilograms. Therefore, the FLW reduction goal aims to reduce this waste by 30 billion kilograms.

Positive Impacts: Two years prior to the announcement of the United States Food Loss and Food Waste Reduction Goal, the USDA announced the United States Food Waste Challenge, which created a platform for numerous stakeholders across the food supply chain to use to collaborate and share best practices. In 2014, the challenge had recruited over 4,000 participants and surpassed its original goal of reaching 1,000 participants by the year 2020. The US EPA Food Recovery Challenge predates the Food Waste Challenge, and also serves as a successful incentive-based tool, with 950 participants. In addition, the national commitment to halve FLW by 2030 has also encouraged better measurement and tracking, as well as more resources for research and innovation.

Key Insights: The historic announcement of the food loss and waste goal has established a set of objectives that will contribute to addressing the issue of climate change, hunger and environmental sustainability. Considering that the United States produces a significant amount of FLW, this policy shift is important, and it is critical to continue to address FLW across the food supply chain.

Sources: Geiling 2015; US EPA 2016; USDA 2015.

Case Study 33. International: The Courtauld Commitment / Waste and Resources Action Programme (WRAP), United Kingdom (UK)

Food Supply Chain Stage: Retail, Foodservice

In 2000, the UK government created the Waste and Resources Action Programme (WRAP), a government-funded NGO that advises businesses on how to reduce waste and use resources efficiently.

In 2007, the UK government published a National Waste Strategy for England. The report introduced several goals, one of which was to focus higher up the waste hierarchy to reduce household waste. To achieve these targets, WRAP was given the mandate and authority to develop and oversee programs and policies that would target different industry sectors and households.

The Government launched the Courtauld Commitment in 2005, a voluntary program encouraging retailers to commit to reducing packaging and FLW. UK businesses (retailers, manufacturers and brand owners) were invited to commit to reducing their waste. While it was launched before WRAP's Love Food Hate Waste (LFHW) program, which targets FLW reduction in the household, the Courtauld Commitment has become closely tied to the LFHW program, recognizing that retail plays an important role in how and why household FLW occurs. The Courtauld Commitment has been rolled out in four phases:

Phase 1 (2005–2010) and Phase 2 (2010–2012): These phases focused on identifying solutions to reduce FLW and primary packaging waste in grocery stores and food retailers. Phase 1 focused on engaging over 40 retailers that signed the agreement to reduce FLW, design out packing waste growth, and reduce the total amount of packing waste. It succeeded in achieving the first two goals, reducing FLW by 270,000 tonnes in 2009/2010 compared to the previous year and reaching zero-growth in packaging waste in 2008. Efforts to reduce the overall amount of packaging were stymied by a 6.4-percent rise in grocery sales. Phase 2 aimed to build on Phase 1 by focusing on household FLW, the carbon impact of grocery packaging, and supply chain product and packaging waste. Through the provision of timely updates, online tools, research and other resources available on its website, WRAP supported signatories in achieving their reduction targets. Phase 2 resulted in a 3.7-percent reduction in household FLW (compared to a target of 4 percent), but avoidable FLW was reduced by 5.3 percent, saving consumers over 700 million pounds (£) and local governments over £20 million each year. Furthermore, it achieved its targeted goal of 10-percent reduction in the carbon impact of grocery packaging, and exceeded its target for reduction in supply chain packaging, achieving 7.4-percent reduction instead of its goal of 5 percent.

Phase 3 (2013–2015): A goal was set to reduce the weight and carbon impact of household FLW and grocery product and packaging waste, both in the home and in the UK grocery sector. The targets were to: reduce traditional grocery ingredient, product and packaging waste in the grocery supply chain by 3 percent, and household food and drink waste by 5 percent, by 2015 (based on a 2012 baseline), resulting in an overall reduction of 9 percent from the 2010 baseline. There were 45 UK signatories—which included retailers, manufacturers and brand owners—to this phase.

Phase 4 (2016–2025): This multi-goal phase targets: 1) resource use in the manufacturing of food, 2) FLW reduction, and 3) GHG emissions reduction through FLW reduction initiatives. The one target aims to reduce resources used in producing food and drink by 20 percent over the period and to reduce



Source: Moore 2016.

FLW by 20 percent in all UK post-harvest sectors, including production, manufacture, distribution, retail, hospitality and foodservice, and households. As of March 2016, over 100 UK-based food retailers, brands, foodservice companies, trade bodies and local authorities had signed up. The food-retail signatories represent over 93 percent of the 2016 UK food retail market.

To help industry maximize FLW reduction actions, WRAP established a Manufacturing and Retail Working Group in 2015. The group is supported by a range of guidance documents, tools and case studies focusing on FLW prevention, as a first priority, redistribution of food surplus, as a second priority, and diverting suitable surplus to animal feed, as a third priority. The information gathered and insights gained will help WRAP develop further strategies to achieve the FLW reduction targets and will inform delivery of Courtauld 2025.

Positive Impacts: According to WRAP, the Courtauld Commitment has been widely embraced by governments and industry: “The Courtauld Commitment receives ministerial backing from all four Governments of England, Northern Ireland, Scotland and Wales. The agreement supports the policy goal of a ‘zero waste economy’ and the objectives of the Climate Change Act to reduce greenhouse gas (GHG) emissions by 34 percent by 2020 and 80 percent by 2050 [...] and major retailers, brands and suppliers have pledged their support.”

WRAP’s involvement with the food industry has been critical to the success of the campaign, as the food industry has helped convey to consumers important environmental messages (i.e., where consumers expect to receive information in order make better purchase decisions about what they buy), and introduce changes at the retail level that make it easier for consumers to take action. Some examples of initiatives introduced by supermarket chains include:

- Sainsbury’s “Love Your Leftovers” campaign;
- Warburton’s removal of “display until” dates from all of its products, leaving a more prominent “best before” date;
- Kingsmill’s reduced product sizes, such as reflected in its “Little Big Loaf;” and
- Tesco’s “Buy One Get One Free Later” (BOGOFL) promotional program.

In Phase 2, the Courtauld Commitment achieved a 1.7-million-tonne reduction in food and packaging waste, having a monetary value of £1.8 billion, or US\$2.2 billion, and a GHG emissions saving of 4.8 million tonnes of CO₂e—and it continues to make impressive strides. As of 2015, signatories had achieved 3.2-percent reduction in grocery ingredient, product and packaging waste, resulting in positive reduction in CO₂e of 3.9 percent.

Key Insights: Following the initial success of the Courtauld Commitment, WRAP has started working with the hospitality and foodservice industry to address FLW. In June 2012, WRAP launched its Hospitality and Foodservice Agreement (HaFSA), under which the foodservice industry voluntarily commits to reducing its food and packaging waste by 5% and increasing recycling to 70%. WRAP has established a number of resources targeting FLW in the hospitality and foodservice sector, including the following:

- A webpage, entitled “Supporting resources for the Hospitality and Foodservice sector,” which is full of resources to help reduce FLW.
- A resource pack for the hospitality and foodservice sector, to help industry members in education and engagement of consumers in reducing plate waste.
- Tracking and measurement work sheets, to help in measuring and monitoring FLW.
- Case studies on foodservice companies that have successfully reduced FLW.

Sources: Moore 2016; WRAP 2010; WRAP 2013; WRAP 2015; WRAP 2016a.

Case Study 34. International: Quantification of Food Surplus, Waste and Related Materials in the Supply Chain / WRAP UK

Food Supply Chain Stage: Retail, Foodservice

The United Kingdom's initiative to reduce FLW is managed by the Waste and Resources Action Programme (WRAP), a registered charity that works with UK governments and other funders to help implement policies and programs on waste prevention and resource efficiency. UK food and drink business sectors participate in Courtauld 2025, a voluntary industry agreement whereby UK stakeholders along the food value chain participate in meeting FLW reduction and prevention targets. They also help the UK meet its commitment to the UN Sustainable Development Goal 12.3.



In 2015, WRAP established a Manufacturing and Retail Working Group to research and develop strategies to address FLW prevention. With oversight from the Working Group, WRAP conducted a comprehensive study in 2016, *Quantification of Food Surplus, Waste and Related Materials in the Supply Chain*, to improve the understanding of FLW data at manufacturing and retail businesses and track the UK's progress toward its FLW reduction goals.

The key research objectives were to:

- estimate the amount of food surplus and waste at grocery retail stores and food manufacturers;
- estimate the amount that might be prevented, donated for human consumption, or diverted to animal feed; and
- identify the most significant causes of food surplus and waste.

The FLW quantification methodologies and definitions used in WRAP's research are consistent with the guidance from the EU FUSIONS project (described in Case Study 35). Data and insights were gathered from multiple published reports and statistics; site visits and waste audits at individual businesses; interviews; and surveys. In particular, the retail FLW datasets were supplied by three of the major UK retailers, providing useful details for evaluation. Data sources for manufacturing quantities included environmental permitting data, the European Waste Catalogue, business registers, and public and industry-conducted surveys of businesses.

Positive Impacts: WRAP's *Quantification of Food Surplus, Waste and Related Materials in the Supply Chain* report is the most comprehensive review of surplus food and FLW amounts from the UK food manufactures and grocery retailers. Its research has applied a new approach to estimating avoidable FLW from the food manufacture and retail sectors and sub-sectors and to how the information can be used for various waste prevention interventions. Participation by major food retailers, who provided product-level datasets on FLW, allowed researchers to developed detailed estimates of FLW and of the potential of specific strategies to avoid FLW.

Key Insights: The report highlights that FLW prevention, donation, and diversion to animal feed, by food manufacturers and retail, could reduce avoidable FLW by 42 percent, saving businesses the equivalent of millions of US dollars per year. All of the UK's major grocery retailers, representing more than 90 percent of the UK market, signed onto the Courtauld Commitment. To maintain industry cooperation, WRAP handles data in strict confidence, with robust security measures in place; it shares only aggregated, sector-level estimates. Data are “sense-checked” by WRAP but are not subject to “spot checks” or “on the ground” validation.

Source: WRAP 2016b.

Case Study 35. International: Food Waste Quantification Manual / EU FUSIONS

Stage of Food Supply Chain: Post-Harvest, Processing, Distribution, Retail, Foodservice

Food Use for Social Innovation by Optimizing Waste Prevention Strategies (FUSIONS) is a collaboration of 21 partners from 13 countries in the European Union as well as 170 European stakeholders across the food supply chain who have committed to reducing FLW. While FUSIONS does not require members and partners to report on their FLW, it encourages member states to measure their FLW levels on a regular basis in order to assess their progress toward UN Sustainable Development Goal 12.3. FUSIONS aims to harmonize FLW measurement definitions and methodologies and to facilitate obtaining data that are more reliable and more consistent and that can be tracked over time.

FUSIONS' 2016 *Food Waste Quantification Manual to Monitor Food Waste Amounts and Progression* provides guidance on quantifying FLW at different stages of the supply chain, based on the framework of the global standard established by the Food Loss & Waste Protocol. It explicitly defines what "food loss and waste" is and suggests (but does not prescribe) quantification methods that can be used.

The manual covers three main activities:

- quantifying FLW in each sector of the food chain;
- combining sectorial quantification, using a common framework at a national level; and
- reporting the results of the national FLW quantification study, at a country level and in a consistent and comparable manner.

Examples of strategies identified for quantifying FLW are presented in the table below.

FUSIONS Strategy Examples for Quantification Methodologies for Food Loss and Waste

Quantification Method Type	Sector	Example
Use existing data	Primary production (e.g., agriculture)	Use farmer or national records on animals sent to slaughter and animal deaths before slaughter.
Undertake a study involving new measurements	Processing and manufacturing	Use EU Prodcom data to combine FLW percentages with production statistics.
Direct weighing or volumetric assessments	Wholesale, retail and markets	Conduct site visits and waste audits at a sample of locations; scale to national level.
Scanning/counting	Wholesale, retail and markets	Scan packaged food items that are being taken for disposal, so that they are recorded electronically, as part of a stock-keeping system.



Food waste quantification manual to monitor food waste amounts and progression

Date: 31.03.16

Reducing food waste through social innovation



Source: EC 2016

Quantification Method Type	Sector	Example
Waste composition analysis	Wholesale, retail and markets	Physically separate, weigh and categorize mixed-solid-waste streams that are not compacted and can be accessed.
Diaries	Foodservice	Log and record what food types are thrown away, and reasons for it.
Surveys	Primary production (e.g., agriculture)	Conduct a confidential survey of a sample of farmers who grow produce representing the top 80% of national production; scale results to non-surveyed farmers to extrapolate national results.
Mass balance	Primary production (e.g., agriculture)	Calculate amount of wheat waste by using data on harvested yields and on imports and subtracting outflows (e.g., amount sold to consumer or as exports)
Models	National organization	Use information on the relationship between the amounts of FLW generated and economic factors, to estimate levels of FLW within an economy.
Proxy data	National organization	Use if information measurement is not feasible due to limited budget or direct access to FLW data, such as amounts of FLW generated by individual sites.

Positive Impacts: The *Quantification Manual* was developed in collaboration with FUSIONS members-state experts and stakeholders, including some team members who had developed the Food Loss and Waste Accounting and Reporting Standard, which provides a globally recognized approach for accounting and reporting standards. The manual is a useful tool that can also be used as a reference by researchers collecting data for national statistical offices and national authorities. Resource Efficient Food and Drink for the Entire Supply Chain (Refresh) is an EU research project that plans to build on the results and experience of the on-going FUSIONS project in order to take further action against FLW. It consists of 26 partners from 12 European countries and China and is funded through 2019 by the Horizon 2020 Framework Programme of the European Union.

Key Insights: Belgium and the UK have already used the FUSIONS *Quantification Manual* to quantify their FLW. At a FUSIONS conference, these countries emphasized that the manual provides a good balance between using common language and methodology, and has the flexibility to use data and strategies that have already been developed.

Sources: EC 2016; WRI 2016.

Case Study 36. International: Mandatory Reporting of Food Waste / Japan

Stage of Food Supply Chain: Post-Harvest, Processing, Distribution, Retail, Foodservice

FLW receives careful attention in Japan, as it used to account for one-fourth of the nation's municipal solid waste stream and has environmental, social and economic impacts. In 2001, Japan enacted the Promotion of Utilization of Recyclable Food Waste Act (Food Recycling Law) to increase the recycling rate of commercial and industrial waste and to decrease food waste and other waste generation. The Food Recycling Law defines FLW as: (1) food materials which are disposed of after being served or without being served as food, and (2) materials which cannot be provided as food and can be obtained as a byproduct in the process of manufacturing processing and cooking by manufacturer, wholesaler, retailer and caterers.



In 2007, the Food Recycling Law was amended to further promote processing FLW into animal feed or fertilizer. The amendment also required food business operators that produce more than 100 tonnes of waste per year to report annually the amount of FLW generated from their manufacturing and distribution processes. Food businesses must also report their recycling efforts to Japan's Ministry of Agriculture, Forestry and Fisheries. If the Japanese government determines that a business' FLW reduction efforts are not sufficient or are out of compliance, the government can provide recommendations and instructions for improvements, publish the name of the company, or impose penalties. The submitted mandatory report responses, in addition to sample surveys for food operators of 100 tonnes or less, are used to estimate FLW for the entire country, for the food operator sectors.

Positive Impacts: The Food Recycling Law raises food business' awareness and actions about the extent of the FLW caused by their business practices. Mandatory reporting for food businesses that generate the largest quantities of waste provides a more robust national estimate of FLW than relying on voluntary reporting alone.

Key Insights: Since the Food Recycling Law was passed, most of the FLW associated with business activities in Japan is now recycled. Japan is heavily dependent on importation of agricultural products and overseas food resources. Its heavy reliance on imports is one of the motivators behind reducing FLW and improving food self-sufficiency: to better protect itself in the event of a potential global food system crisis and its impacts on food insecurity.

Sources: Marra 2013; Parry et al. 2015.

3 Appendix

Interviews in support of these case studies were conducted with stakeholders, in confidence. The objective of the interviews was to collect a diversity of opinions and depth of knowledge across the food supply chain and amongst different stakeholder types. Those interviewees cited in the research are listed by type of stakeholder, position and country of origin. Names and organizations are not listed; this is to protect sensitive and confidential information provided by interviewees.

Interview Number	Position	Country	Type of Stakeholder
C7	Human Resources Manager	Canada	Agricultural Production
C17	Group Leader & Chief Operating Officer	Canada	Foodservice
C32	Director of Business Development	Canada	Nongovernmental Organization
M12	Coordinator	Mexico	Government
M43	Coordinator	Mexico	Nongovernmental Organization
M44	Director	Mexico	Nongovernmental Organization
M71	Vendor	Mexico	Retail
M72	Vendor	Mexico	Retail
U6	Co-founder and CEO	US	Consultant
U22	Life Scientist	US	Government
U32	Founder	US	Nongovernmental Organization
U33	President	US	Nongovernmental Organization
U37	Corporate Social Responsibility Specialist	US	Processing
U39	Sustainability Manager	US	Retail

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